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ABSTRACT

As part of a research framework for a program to improve articulation between the educational and work domains of society, this report describes an attempt to link descriptions of work activities and conditions contained in an Occupation Analysis Inventory (OAI) with certain defined human attributes in the cognitive, affective, and psychomotor domains. The study provides attribute-requirement estimates for the work elements in the OAI, derives basic work dimensions from the attribute-requirement profiles of the OAI work elements, and determines the stability of the resulting OAI dimensions. The application of this research can help to provide counselors with a solid framework for helping students make career decisions. (BH)

HUMAN ATTRIBUTE REQUIREMENTS OF WORK ELEMENTS

Further Development of the Occupation Analysis Inventory

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Report No. 4 of the Ergometric Research and Development Series

Program Director: J. W. Cunningham

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PREFACE

One of the problems facing occupational educators today is that of providing an articulation between the work domain of the real world of modern society and the educational domain. Too often, the ideas surrounding what constitutes education for the world of work are based upon intuition or upon traditional methods or curricula whose slow change lags sadly behind the rapidly changing work domain. The Ergometric Research and Development Program presently under way at the Center for Occupational Education has as one of its principle guiding philosophies the notion that progress in education for the world of work will depend heavily upon the ability of research to produce a viable framework through which the educational and work domains may be interrelated.

Although the total program envisions the development of tested products such as curricula and testing devices for general use in the field of occupational education, the first step is the development of a sound empirically supported foundation in research. This report, the fourth in the Ergometric Research and Development Series, presents one aspect of the foundation which is being built. The report describes an attempt to link the descriptions of work activities and conditions contained in the Occupation Analysis Inventory with certain defined human attributes for which standardized tests presently exist. The results of this research move the program a step closer to the ability to determine the human attributes in the cognitive, affective and psychomotor domain that a job, or cluster of jobs requires.

The implications of this research from a developmental standpoint relate primarily to the guidance and placement functions within educational institutions. Potentially, the application of this research can mean that counselors will be provided with a solid framework for helping students make career decisions.

The Center extends its appreciation to the authors of the report and to the graduate students from the Department of Psychology at North Carolina State University who assisted as raters on the project. A special note of thanks goes to Mr. William Ballenger and Mrs. Faye Childers for their assistance in the compilation and processing of the data for the report. Finally, the Center recognizes the assistance of its technical and editorial staff in the preparation of the report for final publication.

John K. Coster
Director

SUMMARY

The present report, the fourth in the Ergometric Research and Development Series, describes an attempt to establish linkages between the work elements (descriptions of activities and conditions) in the Occupation Analysis Inventory and a set of defined human attributes in the cognitive, affective, and psychomotor domains.

Specifically, the purpose of this study was threefold: (1) to derive attribute-requirement estimates for the work elements in the Occupation Analysis Inventory (OAI), (2) to derive basic work dimensions (factors) from the attribute-requirement profiles of the OAI work elements, and (3) to determine the stability of the resulting OAI dimensions.

The first phase of the study involved the development of an Attribute Requirement Inventory (ARI), containing definitions of 103 human attributes for which there are identifiable tests. Following construction of the ARI, judges were employed to rate the "Degree of Relevance" of each ARI attribute to each of the work elements (items) in the OAI. Attribute weights were then computed for the OAI elements by averaging judges' ratings for each work element on each of the attributes. An analysis of inter-rater agreement indicated substantial reliabilities for the attribute weights.

Next, six separate groups of OAI work elements were intercorrelated based on attribute-requirement profiles, and each of the six correlation matrices was factor analyzed. The six analyses yielded 77 factors, or work dimensions, all of which were interpreted.

The rating data were then divided into two samples, and six factor analyses were performed on each sample. Evidence of factorial stability was obtained through comparisons across the two samples using Tucker's coefficient of congruence (applied to factor loadings) and the Pearson product-moment correlation (applied to factor scores).

Finally, the 77 first-order factors were subjected to a higher-order factor analysis, which produced 21 interpretable dimensions.

It was noted that the factors derived in this study are subject to a different interpretation than those derived from ratings of occupations on the OAI and that this difference might have some bearing on their application.

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INTRODUCTION

With the increasing rate of change in our society and work technology, it is imperative that the individual possess capabilities which are transferable across a variety of work situations. The increasing number and variety of jobs renders impracticable the traditional practice of developing a separate educational program for each occupational title (Dillon and Horner, 1968; Face, 1967). Moreover, it would be infeasible to base occupationally related curricula in the early grades (e.g., occupational awareness and exploration curricula) upon individual occupations.

This situation points to the need for a comprehensive taxonomy of human work which could be used to impose some structure and parsimony upon occupational education (Cunningham, 1971; Cunningham, Tuttle, Floyd, and Bates, 1971). One concept which has emerged in response to this need has been termed "occupational clustering"--the grouping of occupations with similar educational requirements. According to the rationale behind the clustering approach, it should prove feasible to develop curricula providing knowledges and skills common to occupations within clusters. This approach could prove applicable at several levels in occupational education, including occupational awareness and exploration curricula, curricula directed toward general vocational capabilities, and curricula at the vocational, technical, and professional levels. The cluster concept raises some troublesome questions, however, concerning the definition and measurement of the variables by which occupations should be described, compared, and grouped for educational purposes (Cunningham, 1969, 1971; Cunningham et al., 1971). To date, little effort has been directed toward answering these questions.

The Occupation Analysis Inventory (OAI) developed at the Center for Occupational Education was conceived as an initial step toward a scheme for describing and classifying occupations for educational purposes (Cunningham et al., 1970, 1971). The items, or work elements, comprising the OAI consist of statements describing various classes of work activities and conditions. These work elements represent an effort to achieve as high a level of descriptive specificity (or content loading) as possible, while retaining applicability to the entire spectrum of occupations. In addition to describing occupations in terms of observable events, however, it was felt that the OAI scheme should also provide occupational descriptions in terms of human attribute requirements--that is, in terms of measurable human characteristics in the cognitive, psychomotor, and affective domains. For this purpose, the OAI work elements were to be linked with certain human dimensions for which there are tests. Such linkages would provide the means for transforming ratings of occupations on the OAI work elements into estimates of the human attribute requirements of the rated occupations. The feasibility of this "synthetic" approach to determining the attribute requirements of jobs and occupations has been demonstrated by the research of E. J. McCormick and his associates at Purdue University

(McCormick, Cunningham, and Thornton, 1967; Mecham and McCormick, 1969a, 1969b).

The present study is concerned with (1) deriving estimated human attribute requirements for the OAI work elements, (2) deriving basic work dimensions (factors) based on the attribute-requirement profiles of the OAI work elements, and (3) determining the stability of the resulting OAI work dimensions. The OAI work dimensions and attribute-requirement estimates might ultimately be applied in such areas as: curriculum development, curriculum evaluation, guidance and placement, test development, and educational planning. The potential applications of the OAI have been discussed in greater detail in a previous paper (Cunningham, Tuttle, Floyd, and Bates, 1971).

RESEARCH INVOLVING INDIRECT VALIDITY AND THE DERIVATION OF WORK DIMENSIONS

Ghiselli (1959, 1966) has pointed to the need for a more analytical approach to test validation which would allow empirically established validity to be generalized from one job situation to another. His proposal was based on extensive reviews of the literature reporting validity coefficients of various aptitude tests in predicting job success (Brown and Ghiselli, 1953; Ghiselli, 1966; Ghiselli and Brown, 1951). In these reviews, Ghiselli and Brown found great variations in test validity coefficients within rather narrow job categories, with the greatest variation attributable to the type of criterion used.

The practice of inferring the validity of a test in a given job situation, based on the test's previously demonstrated validity in similar situations, has been termed indirect validity (McCormick, 1959). The concept of indirect validity might, in turn, be subdivided into two more specific approaches: generalized validity and synthetic validity (Lawshe, 1952). Lawshe defines generalized validity as:

> . . . an extension of . . . [the classical approach] in that validity statements are assumed to apply to other populations, but only after samples from numerous populations have indicated a somewhat universal validity (p. 32).

He defines synthetic validity as:

> . . . the inferring of validity in a specific situation [in a manner] . . . similar to that involved when the time study engineer establishes standard times for new operations, purely on an a priori basis, through the use of "synthetic" times for various elements constituting the operation [p. 32].

Similarly, Balma (1959) defines synthetic validity as:

> . . . the inferring of validity in a specific situation from a logical analysis of jobs into their elements, a determination of a test validity for these elements, and a combination of elemental validities into a whole [p. 395].

Thus, generalized validity involves validity inference on the basis of gross, overall job similarities, whereas the synthetic validity approach involves (1) the establishment of test validities for each of a set of work components, (2) the analysis of specific jobs in terms of these basic work components, and (3) based on work-component analysis, the identification of tests which would validly predict success in the jobs analyzed.

Since the concept of synthetic validity underlies the procedure employed in the present study, a review of previous research under this topic is presented in the following sections. Also contained in this review is a discussion of previous research in which work dimensions were derived based on the attribute-requirement ratings of jobs and work elements.

Direct Trait-Requirement Ratings of Jobs

One method of estimating trait-requirements of jobs is to identify important traits and then to rate these traits directly on the extent to which they are required by each of a number of jobs. The resulting ratings can subsequently be used to derive (1) trait-requirement profiles for jobs and (2) trait factors and job clusters (or factors) based on the trait-requirement profiles of jobs. The following two sections review studies that used the direct job-rating approach in deriving trait-requirement estimates and work dimensions.

Indirect Validity Based on Trait-Requirement Ratings of Jobs

The first step in this approach to indirect validity involves defining a set of worker traits which are relevant to job performance. Next, job requirements on these traits are established on the basis of direct ratings assigned to each job for each trait. Finally, tests are selected which measure the traits relevant to a particular job.

Viteles (1932), in attempting to systematically estimate the trait requirements of jobs, developed the "job psychographic method" of job analysis. This method involves the definition of 32 mental traits determined to be relevant to job performance. Jobs are then rated on the extent to which they require each of the defined traits. For a particular job, the ratings are graphically recorded on a form such that traits rated as very important to job success show up as peaks on the form. These peaks, or "'keystone' specific mental abilities" can be readily identified and are considered to be the abilities which must be "tapped" in predicting success for that job.

Another systematic attempt to estimate the human attribute requirements of jobs resulted in the Minnesota Occupational Rating Scales (Paterson, Gerken, and Hahn, 1941). The Minnesota Scales contain a list of 430 jobs rated by 20 vocational psychologists on six human abilities. Both the abilities and a four-level rating scale for each ability were defined. The ratings were averaged and a profile of abilities for each job was obtained. These profiles are offered for use by counselors in matching individual test profiles with the ability-requirement profiles of jobs. The Revised Minnesota Rating Scales (Paterson, Gerken, and Hahn, 1953) are a continuation of the work done on the original Minnesota Scales. The revised scales differ from the original scales by the inclusion of added occupations and ratings on an additional ability. In the revised scales, the levels to be rated were simplified, and D.O.T. numbers were assigned for cross reference purposes. In addition, a Counseling Record was developed to help a counselor match people to jobs.

Other work involving the ratings of jobs on human trait requirements has been carried out by the United States Employment Service (USES). More than 4,000 jobs from the Dictionary of Occupational Titles has been rated by trained analysts on 48 trait requirements (U. S. Employment Service, undated). The traits include aptitudes, interests, temperaments, and physical capacities. These ratings form attribute-requirement profiles for jobs which can then be used for counseling, selection, and placement purposes. Some evidence for the validity of the USES aptitude-requirement ratings was obtained by Trattner, Fine, and Kubis (1955) from a study in which 10 jobs were rated on 10 aptitudes by two groups of raters. One group of raters used written descriptions of the jobs to be rated as the basis for their ratings, while the other groups performed their ratings on the basis of direct job observation. The resulting aptitude ratings were then correlated with the average GATB test scores (for the 10 aptitudes) of workers in the rated jobs. The results of the study showed (1) a substantial consistency between the ratings based on the two different sources of job information and (2) correlations ranging from .44 to .58 between the ratings and the average GATB test scores of incumbents in the 10 jobs. The investigators interpreted these correlations as indicating a satisfactory degree of consistency with test data.

A series of studies by Primoff (1953, 1955, 1957, 1959) has dealt not only with the estimation of attribute requirements of jobs, but also with a method for estimating test validities, the "J-coefficient." In the derivation of a J-coefficient, qualified judges (usually six to ten) rate, on a three-point scale, the importance of each of a list of human abilities to a particular job. The resulting ratings are averaged to produce an ability-requirement profile for the job. In addition, estimates are obtained (from a table) of the extent to which each of the abilities contributes to performance on each of a specified pool of tests. These latter estimates, or "Beta weights," were originally based on the judgment of a group of psychometrists, but have been revised as actual validity data have been obtained. Finally, a J-coefficient is computed for each test by applying a formula to the ability-requirement estimates for the job and the Beta weights for the test. The resulting J-coefficient is an estimate of the correlation between scores on the test and performance on the job.

One study in which the J-coefficient technique was used was reported by Wherry (1955). In this study, 54 Printer Assistants were administered five tests. J-coefficients were then computed for the five tests and compared with the actual validity coefficients for the same tests. The correlation between J-coefficients and validity coefficients was .55. In the follow-up study, a sample of 135 new workers was used and the correlation was .93. Wherry concluded that these results offer some "empirical evidence" for the J-coefficient method.

Dimensions Derived from Trait-Requirement Ratings of Jobs

The work reviewed thus far involved establishing the trait requirements of jobs based upon direct job ratings on specified human attributes. Several studies have employed such ratings in deriving basic attribute dimensions, or factors. The rationale for this approach is that the analysis of intercorrelations among the trait ratings of a representative sample of jobs might yield basic trait dimensions for which job requirements could be established. Furthermore, it might be possible to cluster jobs on the basis of their trait-dimension profiles and to establish average trait-requirement profiles for the resultant job clusters. The trait profiles of people could then be compared with the trait-dimension profiles of job clusters.

One of the first attempts to derive dimensions from attribute ratings of jobs involved the rating of 275 occupations on the extent to which they required 20 human traits, one skill, and two job characteristic variables (Jaspen, 1949). The 20 traits were selected from the 45 traits included in the Worker Characteristics Form of the U. S. Employment Service. These ratings were intercorrelated, and the resulting matrix was factor analyzed. Although eight factors were obtained, only six of these were interpreted. These factors were labeled: (1) Strength, (2) Intelligence, (3) Inspection, (4) Physically Unpleasant Working Conditions, (5) Manual Dexterity, and (6) Mechanical Information.

In another study, McCormick, Finn, and Scheips (1957) factor analyzed the USES ratings of 4,000 jobs on 44 human attributes (U. S. Employment Service, undated). Seven factors were identified in this analysis: (1) Mental and Educational Development versus Adaptability to Routine, (2) Adaptability to Precision Operations, (3) Body Agility, (4) Artistic Ability and Aesthetic Appreciation, (5) Manual Art Ability, (6) Personal Contact Ability versus Adaptability to Routine, and (7) Heavy Manual Work versus Clerical Ability. Next, factor scores were derived for each job on each of the seven factors. The factor scores were then divided into "High" and "Low" levels, with the exception of one factor which was divided into "High," "Average," and "Low" levels. From these factor score levels, 192 unique factor score "patterns" (or permutations) were obtained. It was found, however, that 33 patterns accounted for 88 percent of the jobs and that 115 patterns accounted for all of the jobs. The authors interpreted these findings as evidence that jobs can be classified according to a limited number of attribute requirement patterns.

In a study reported by Norris (1956), 159 Air Force enlisted jobs were rated on the level at which each of 170 defined human traits was required in the job. The ratings of 130 of the most reliable and important traits were intercorrelated, and the resulting matrix was factor analyzed. Of the 25 identified factors, only 11 were interpreted: (1) Managerial Ability, (2) Speed, (3) Social-Verbal Facility, (4) Strength, (5) Reasoning, (6) Accuracy, (7) Spatial Visualization, (8) Foot-Hand Coordination, (9) Emotional Control, (10) Mechanical Ability, and (11)

Manual Dexterity. These factors, along with seven traits which had considerable variance not accounted for by the 11 factors, comprised 18 dimensions which the author saw " . . . as a useful framework for describing the requirements of Air Force enlisted jobs" (p. 15).

Another investigation employing the USES trait ratings has been reported by Orr (1960). In this study, "Distance (D) Measures" based on nine aptitude ratings were computed for pairs of jobs, such that a large D-score represented a large difference in the aptitude profiles of the jobs in a pair. Two independent samples of 140 jobs were selected from the 4,000 jobs which had been rated on the USES traits, and D scores were computed among the jobs within each sample. These D-scores were then subjected to cluster analysis within each of the two samples, yielding six job clusters for each sample. The resulting clusters were paired across samples. Next, each of 28 jobs from a third sample was assigned to that cluster in both original samples for which the job's D-score from the cluster centroid was the smallest. Using this method, Orr found that 75 percent of the jobs in the third sample fell into matched clusters. He interpreted this result as support for the use of the clustering procedure. The six clusters seemed to represent different levels of three broad job areas: (1) intellectual-supervisory, (2) mechanical-manual, and (3) clerical.

Trait-Requirement Ratings of Work Elements

In the previously cited studies, trait-requirement estimates were derived from direct trait-requirement ratings of jobs. Another approach to this problem is to develop a comprehensive inventory of "work elements" that define various aspects of work, and then establish the trait requirements of these individual work elements. The trait-requirement profiles of the work elements can then be factor analyzed to obtain basic work dimensions, or these profiles can be combined with ratings of jobs on the work elements to obtain trait-requirement estimates of jobs. In the following sections, studies involving trait-requirement ratings of work elements are reviewed.

Indirect Validity Based on Trait-Requirement Ratings of Work Elements

As mentioned earlier, the synthetic-validity approach involves: (1) defining a set of basic work elements (activities and conditions), (2) rating the work elements on trait requirements, (3) rating jobs on the work elements, and (4) combining information from the preceding steps to derive attribute-requirement estimates for jobs. In describing work elements, McCormick (1959) distinguished between "job-oriented" and "worker-oriented" elements. He defined a job-oriented element as a statement describing what is accomplished in the job, and a worker-oriented element as a statement describing what the worker actually does. According to McCormick, worker-oriented statements are more suitable for describing a wide variety of jobs, since these variables, as contrasted with job-oriented statements, are independent of the specific technological aspects of jobs.

A study using job-oriented elements to describe jobs is reported by Lawshe and Steinberg (1955). In this study supervisors identified the five most important activities in the Job Description Checklist of Clerical Operations (a 139-item job-analysis inventory) for each of 262 clerical positions in 12 companies. In addition, the workers in these positions were administered the Purdue Clerical Adaptability Test. Prior to this study, the 139 items in the checklist had been rated by 15 judges on the extent to which each work element required various aptitudes represented in the Purdue Clerical Adaptability Test (i.e., spelling, memory for oral instructions, arithmetic computation, checking, vocabulary, accuracy of copying, and arithmetic reasoning). An expectancy chart was then prepared for each aptitude, relating the number of activities for which the specified aptitude was rated critical to a position, with the percentage of incumbents in the position who scored above the median on the subtest for that aptitude. Chi-square values were computed for each of the seven subtests to determine if the percentage of workers scoring above the median for that subtest was significantly related to the number of activities (in their positions) for which that aptitude was critical. The results showed significant differences for the aptitudes of spelling, arithmetic computation, vocabulary, and arithmetic reasoning. The investigators concluded that these results support attempts to "synthetically" determine the test requirements of jobs.

In contrast to job-analysis inventories using job-oriented variables are those using worker-oriented variables. In two series of studies, McCormick and his associates have used worker-oriented inventories to derive trait requirements of jobs. In the first series (Cunningham and McCormick, 1964a, 1964b; Gordon and McCormick, 1963; McCormick, Cunningham, and Gordon, 1967; McCormick, Cunningham, and Thornton, 1967; Thornton and McCormick, 1964), a checklist of worker-oriented elements, the Worker Activity Profile (WAP), was developed which follows the basic conceptual approach taken in the development of an earlier checklist by Palmer and McCormick (1961). Two samples, one involving 400 jobs and the other 371 jobs, were rated on the WAP. For both samples, 119 reliable items were factor analyzed. When the resulting factors were compared across the two samples, 22 of 28 factor pairs were found to be congruent, or similar, thus indicating a stable structure of work dimensions (Cunningham and McCormick, 1964a; Gordon and McCormick, 1963; McCormick, Cunningham, and Gordon, 1967).

The next phase in the WAP research series involved the derivation of attribute-requirement estimates for jobs, based upon WAP ratings (Cunningham and McCormick, 1964b). Forty-two attributes were selected, with some modification, from the list of traits defined by the U. S. Employment Service (1956). These included aptitudes, motor abilities, temperaments, interests, and physical capacities. Each WAP work element was rated (by three to five judges) on the extent to which it required each of the specified human attributes. The median rating of each work element on a given attribute was then multiplied by the rating of a job on the same work element. An attribute-requirement estimate for a particular job was obtained by summing the products of attribute weights and job ratings across all work elements. Attribute-requirement estimates were thus obtained for a sample of 401 jobs selected from the list of 4,000 for which USES trait ratings were available. The WAP attribute-requirement scores for the 401 jobs on 37 of the 42 attributes were then correlated with corresponding USES trait ratings for the same jobs. All but five of these correlations were significant in the expected direction. Although the correlations were generally highest for aptitudes (average correlation .56) and motor abilities (average correlation .42), there were also some substantial correlations in the other groups of attributes.

In attempting to establish the validity of the WAP attribute-requirement estimates, Thornton and McCormick (1964) carried out a study using a sample of 43 Naval job specialties for which test validity coefficients had been determined. Validity coefficients were available for four tests: General Classification (Intelligence), Clerical, Arithmetic (including two subtests), and Mechanical (including three subtests). Attribute scores were derived for each specialty in the manner described above. Attribute scores were also obtained for the specialties by deriving attribute weights for each of the aforementioned WAP factors (based on the weights of individual items comprising the factors), and then summing the cross-products of attribute weights for the various factors by the factor scores of the job in question. These attribute scores were then correlated with (1) 125 validity coefficients for corresponding tests (four tests and five subtests) obtained from 125 separate validity studies of the 43 Navy specialties, and (2) 43 average validity coefficients for each test and subtest within each Navy specialty. These analyses yielded all significant correlations for attribute scores derived through the use of WAP factors. Correlations for attribute scores derived from individual WAP items were significant in eight out of nine cases using the 125 individual validity coefficients and in six out of nine cases using validity coefficients averaged within the 43 Navy specialties.

In a subsequent series of studies, McCormick, Jeanneret, and Mecham (1969a, 1969b) developed a new 189-item job-analysis inventory, the Position Analysis Questionnaire (PAQ), which they considered a marked improvement over the WAP. In the first study involving this instrument (Mecham and McCormick, 1969a), 178 PAQ work elements were rated by 8 to 18 judges on 68 human attributes (of either an "aptitudinal" or "situational" nature), in terms of the "relevance" of each attribute to each work element. The inter-rater reliability coefficients of the mean attribute ratings averaged .91, with only six of the 68 reliability coefficients falling below .80. Median values were also derived for each of 67 attributes on every item of the PAQ. These medians provided an attribute-requirement profile for each work element.

In a second study (Jeanneret and McCormick, 1969), 536 jobs were rated on the PAQ through direct observation by job analysts. These ratings were then used in several factor analyses of the PAQ work elements. An overall factor analysis of the PAQ items yielded five dimensions, and separate analyses of the six major PAQ sections produced 27 additional dimensions. Similar factor analyses were also performed using the aforementioned attribute profiles on the PAQ work elements as the basis for intercorrelating these elements. This part of the study yielded 21 factors, several of which are similar to those obtained in the factor analyses of job ratings.

In the last PAQ study (Mecham and McCormick, 1969b), two analyses were carried out to determine the "validity" of synthetically estimated attribute-requirement estimates for jobs. For these analyses, 179 positions were selected from the 900 that had been rated on the PAQ. These positions, in turn, corresponded to 90 D.O.T. (Dictionary of Occupational Titles) job titles for which General Aptitude Test data were available (through the U. S. Employment Service) in the form of both mean test scores of incumbents and validity coefficients. These data served as criterion variables for the analyses which are described next.

In the first analysis, scores were obtained for the 179 positions on two sets of PAQ work dimensions: (1) the 27 factors derived from job ratings on the PAQ work elements, and (2) the 21 factors derived from attribute profiles of PAQ work elements. A multiple correlation analysis was then carried out relating work-dimension (factor) scores for the 179 positions to both sets of criterion variables mentioned above. For each test, a set of work dimensions was selected consisting of the factors having the highest bivariate correlations with the criterion variable; a multiple correlation was then computed between the selected set of factors and the criterion. The results were as follows: (1) against the test-score criteria, dimensions based on job data yielded multiple correlations with a median of .71, and those based on attribute profiles yielded multiple correlations with a median of .70; (2) against the criteria of validity coefficients, job-data dimensions yielded multiple correlations with a median of .47, and attribute dimensions yielded multiple correlations with a median of .44. These results indicate a significant predictability of GATB test scores and validities by combinations of PAQ factors.

The second analysis involved correlating PAQ attribute-requirement estimates for the 179 positions with the two sets of criterion variables; nine sets of PAQ attribute-requirement estimates were correlated with the mean scores and validity coefficients of the nine corresponding GATB tests. The attribute profiles for jobs were obtained through a series of three steps. First, a profile on the 67 attributes were derived for each of the 21 work dimensions that had been identified through factor analyses of the attribute profiles of work elements. An attribute-requirement profile for a particular work dimension was based on the attribute-requirement profiles of the work elements (items) comprising that dimension. Next, a factor score was derived for each of the 179 positions on each of the same 21 dimensions. (A factor score was the sum of the cross-products of weights of the work elements on a dimension, times the ratings of a position on the elements.) Finally, each attribute-requirement estimate for a position was obtained by taking the sum of the cross-products of the position's score on each work dimension times the weight for that dimension on the attribute in question. The correlations between attribute-requirement estimates for positions and the average scores of incumbents on corresponding tests was substantial for cognitive abilities (with a range of .31 to .70 and a median of .60), but negligible for perceptual and psychomotor abilities (with a range of -.24 to .16 and a median of .03). The correlations between attribute estimates and corresponding validity coefficients were, for the most part, negligible.

Based on their findings, Mechan and McCormick concluded that the " . . . results of the study support quite strongly the basic notion that . . . job attribute requirements can be derived synthetically on the basis of reasonably objective job analysis data, specifically quantitative data that reflect job characteristics and/or job dimensions of a worker-oriented or behavioral nature [1969b, p. 14]."

Dimensions Derived from Trait-Requirement Ratings of Work Elements

A study in which dimensions were derived from trait-requirement ratings of work elements has been reported by Thorndike et al. (1957). In this study, a follow-up of the previously cited study by Norris (1956), a Job Activities Blank was constructed containing 7 to 20 activity statements for each of 14 of Norris' 18 trait dimensions. A sample of 963 men in 25 Air Force jobs rated each activity in terms of frequency of performance. Trait-dimension scores were obtained for each of the 963 positions by summing the ratings for the activity items representing the dimension; dimension scores were obtained for each of the 25 jobs by averaging the dimension scores of the positions corresponding to the job. A factor analysis of the 14 oblique trait dimensions, using the 25 jobs as cases, yielded 8 orthogonal trait dimensions. The two sets of dimensions (oblique and orthogonal) were then used as a basis for computing "distance" (D) scores for all pairs among the 25 jobs, and each set of D-scores was subjected to a cluster analysis. The correlation between the two sets of D-scores was .91, indicating good correspondence between the two methods of measuring job similarity. However, only two general clusters were identified: a mechanical cluster and a non-mechanical cluster. The investigators concluded that the substantial correlations among the original trait dimensions had reduced their effectiveness in describing job requirements and clustering jobs.

Work dimensions were also derived from the trait-requirement ratings of the PAQ work elements. In the previously cited study by Jeanneret and McCormick (1969), three different multivariate procedures were used to derive dimensions based on the attribute-requirement profiles of the PAQ work elements (items). Principal components analyses of the six major sections of the PAQ yielded 21 dimensions, a number of which were similar to dimensions obtained from the factor analyses based on ratings of jobs on the PAQ elements. In fact, the dimensions based on the attribute-requirement profiles of the PAQ items accounted for more of the total variance and were easier to interpret than the dimensions derived from job ratings. Two clustering procedures were also applied to the attribute profiles of the PAQ elements. The first clustering procedure, employing item intercorrelations (Lorr and Radhakrishnam, 1967), was applied to profiles comprised of 17 aptitude-requirement estimates for the various PAQ work elements. This analysis produced six dimensions (or clusters) of PAQ elements, five of which were interpreted. The second clustering procedure, a hierarchical grouping analysis (Ward, 1961; Ward and Hook, 1963), was applied both to the aptitude profiles and to profiles based on the entire list of 67 human attributes. The analysis of the aptitude profiles yielded 18 item groups, several of which were uninterpretable; however, the analysis of complete attribute profiles produced 22 interpretable item groups out of a total of 23. Seven of these latter groups were given titles identical to dimensions derived through factor analysis. In discussing their results, Jeanneret and McCormick concluded that, despite the different procedures used, there were " . . . several similarities, indicating that there appears to be a common 'core' of attribute requirements underlying various job activities and work situations [p. 103]."

Implications

The studies cited in the preceding review demonstrate that (1) it is feasible to derive human attribute-requirement estimates for jobs through systematic job-analysis procedures and (2) that stable work dimensions can be derived from attribute ratings of jobs and work elements. The present study deals with the application of quantitative job-analysis procedures, particularly those developed by E. J. McCormick, to the development of a system that might ultimately find use in the field of occupational education.

PURPOSE

This study is part of a series designed to develop and test a quantitative system for describing and classifying occupations for educational purposes. The first phase of this series involved the development of a comprehensive job-rating instrument, the Occupation Analysis Inventory (Cunningham et al., 1970, 1971). As noted previously, the OAI was designed to achieve as high a level of descriptive specificity (or content loading) as possible, while retaining its applicability to the general population of jobs and occupations. The purposes of the present study are described below.

Deriving Attribute Requirements for the OAI Work Elements

One way of estimating the human attribute requirements of jobs involves: (1) establishing attribute requirements for each of a set of individual work elements, (2) rating jobs on these work elements, and (3) combining the job ratings and attribute weights to obtain attribute-requirement estimates for the jobs. Evidence for the feasibility of this method can be found in the research of E. J. McCormick and his associates (McCormick, Cunningham, and Thornton, 1967; Mecham and McCormick, 1969a, b). One purpose of the present study was to derive attribute-requirement profiles for the OAI work elements.

Factor Analyses of the OAI Work Elements

A comprehensive set of work dimensions by which jobs and occupations could be described, compared, and classified would have relevance to a number of educational problems (see p. 1 of present paper, and Cunningham et al., 1971). Accordingly, the second purpose of this study was to derive a set of basic work dimensions through factor analyses of the OAI work elements, using the attribute-requirement profiles of the work elements. The final purpose of the study was to determine the stability (or replicability) of the derived work dimensions.

PROCEDURE

Two instruments, the Occupation Analysis Inventory (OAI) and the Attribute Requirement Inventory (ARI), were used in this study. Descriptions of these two instruments and the data gathering and analysis procedures are presented below.

The Occupation Analysis Inventory (OAI)

The Occupation Analysis Inventory (OAI) is a rating device designed for the systematic description of jobs and occupations (Cunningham *et al.*, 1971). The items, or work elements, in the OAI consist of written descriptions of classes of work activities or conditions, along with specific examples for each class. The Inventory contains 622 work elements grouped under the following major headings:

1. Information Received (125 elements)
2. Mental Activities (41 elements)
3. Work Behavior (267 elements)
4. Work Goals (112 elements)
5. Work Context (77 elements)

These five categories correspond to the five components of the information processing model shown in Figure 1.

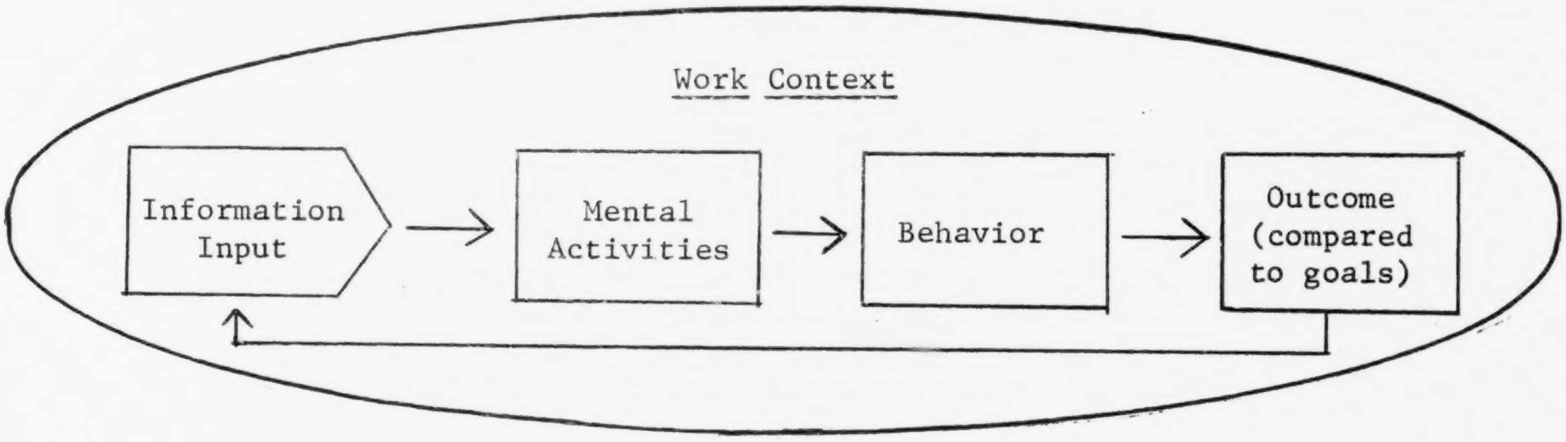

Figure 1. Paradigm for the Occupation Analysis Inventory (OAI)

The work elements of the OAI are generally rated on three standard scales. Two of these scales, Significance to the Job and Extent of Occurrence, are six-point scales (0-5), while the third scale, Applicability, is dichotomous. In addition, certain OAI items have special scales which are contained in, and apply specifically to, the work element in question. The points on the OAI scales are defined by written descriptions, some consisting of definitions only and others consisting of definitions plus examples.

The Attribute Requirement Inventory (ARI)

The Attribute Requirement Inventory (shown in Appendix B) contains 103 definitions of human attributes that have been identified as potentially useful in describing the human requirements of jobs. These attributes fall into the following six categories:

1. General Vocational Capabilities (24 attributes)
2. Cognitive Abilities (20 attributes)
3. Psychomotor Abilities (12 attributes)
4. Sensory Capacities (6 attributes)
5. Interests (24 attributes)
6. Needs (17 attributes)

The General Vocational Capabilities were selected from those defined by Altman (1966). These attributes represent knowledges and skills relevant to a wide variety of occupations but which are more occupationally specific than basic aptitudes and academic abilities. In identifying these general vocational capabilities, Altman first drew a sample of 31 occupations which were thought to have major employment opportunities for the coming decade. Task descriptions were then developed for each occupation, and a sample of task behaviors was selected from each occupational description and translated into multiple-choice test items. Tests were formed by having psychologists sort the items into 24 rationally defined capability categories. The resulting 24 tests were ordered along a hardware-to-people continuum divided into the following six areas: (1) Mechanical, (2) Electrical, (3) Spatial (including structures and layout and visualization), (4) Chemical-Biological, (5) Symbolic (including numerical operations and verbal communication), and (6) People. Intercorrelations among the tests were generally consistent with the hypothesized hardware-to-people continuum: tests close together on this continuum were more highly correlated than tests further apart.

The Cognitive Abilities were adapted, for the most part, from those described by French, Ekstrom, and Price (1963). The abilities measured by the General Aptitude Test Battery of the U. S. Employment Service and the Differential Aptitude Test Battery (Bennett, Seashore, and Wesman, 1966) are also represented in the ARI. (Most of the GATB and DAT tests can be matched with factors identified by French _et al._) The factors presented by French, Ekstrom, and Price were selected from the many cognitive factors identified by various researchers. All of these factors (24 in number) were identified in at least two, and in most cases several, studies. The authors, along with the help of many collaborators, supplied definitions for each factor along with a description of the factor, its relationship to other factors, and evidence for the factor's existence. They also selected three tests to measure each factor and presented descriptions of these tests in their discussion of the factor. The factors selected for inclusion in the ARI consisted of those though to be (1) relevant to work analysis and (2) defined concretely enough to be potentially ratable.

The Psychomotor Abilities were adapted from the factors identified in a series of studies by Fleishman (1967). The psychomotor factors included in the ARI were selected on the same bases as the cognitive abilities.

The Interests defined in the ARI were adapted from the Ohio Vocational Interest Survey (1969). The conceptual approach used in the development of the Ohio Vocational Interest Survey (OVIS) was borrowed from the Data-People-Things scheme employed by the U. S. Employment Service. In the derivation of the OVIS scales, the 114 worker-trait groups identified in the Dictionary of Occupational Titles were plotted in three-dimensional space using the dimensions of Data, People, and Things. When plotted, these 114 groups fell into 24 clusters, each of which was used to form a scale of the OVIS. The interest scales were comprehensively defined, and questionnaire items were written for each scale. These items represented job activities from the worker-trait groups included in the scale definition. The instrument consisting of the original items has been refined by reducing scale intercorrelations, increasing scale homogeneity, and improving reliabilities.

The Needs were adapted from the Minnesota Importance Questionnaire (MIQ), which was one of a number of instruments developed in accordance with the Theory of Work Adjustment (Weiss et al., 1966). The 20 scales of the instrument were derived from studies of need-fulfillment carried out by many researchers. These 20 scales were designed to comprehensively cover the most important, identifiable human needs. Of the 20 scales represented in the MIQ, 17 were chosen to be included in the ARI.

The attributes included in the ARI were selected for several reasons. First, those attributes selected were considered to be most representative of the attributes consistently identified in each area (i.e., Cognitive Abilities, Interests, Needs, etc.). Second, only attributes considered suitable for job-analysis purposes were included. Third, in the case of General Vocational Capabilities, Cognitive Abilities, Interests, and Needs, attributes were selected for which there were easily administered tests. This last point is important since, to establish the validity of synthetically derived estimates of attribute requirements of jobs, direct measures of the attributes are needed. A list of the tests that measure each of these attributes is presented in Appendix A.

Prior to the construction of the ARI items, the available definitions and other information concerning the selected attributes were reviewed. Based on this information, a comprehensive description was written for each attribute. In addition, job or work activity examples were supplied (for all categories of the ARI except Needs) to aid in understanding the attribute definition. These examples represented jobs or work activities requiring a substantial amount of the attribute in question. The ARI attribute definitions are presented in Appendix B.

Raters

The raters in this study were recruited from the Department of Psychology, North Carolina State University at Raleigh. All of the raters were required to have some measurement background. All of the 13 raters recruited were graduate students, seven of whom had received their Master of Science degree.

Rating Procedure

Each rater was given a copy of the OAI, a copy of the ARI, a set of answer sheets, and a set of instructions. The raters were assigned a number of attributes to rate based on the time they had available. By this method, each ARI attribute was assigned to nine to ten raters.

All raters were instructed to rate each OAI item (using a 0-5 scale) on the "Degree of Relevance" of the ARI attribute in question to the work element described in that OAI item. Since two categories of attributes defined in the ARI appeared inherently different, "Degree of Relevance" was defined for the General Vocational Capabilities, Cognitive Abilities, Psychomotor Abilities, and Sensory Capacities as the "amount" or "level" of the attribute in question required of the incumbent to deal effectively with the OAI work element. For Interests and Needs, however, "Degree of Relevance" was defined as the extent to which the attribute in question is "compatible" with the OAI work element. When rating each OAI work element, the raters assumed that element to be a very significant part of a hypothetical job. The items in the Mental Activities category of the OAI were excluded from the ARI ratings, since they represent basic cognitive factors which did not seem suitable for this purpose. (However, the investigators later assigned weights to the Mental Activities items on selected cognitive abilities in the ARI.) A complete set of rating instructions is presented in Appendix B.

When the rating forms were returned, they were checked for completeness and coded as to rater, attribute, and OAI section. The ratings were then key-punched into data processing cards.

Analyses

After all data had been collected, the following analyses were carried out. All of the statistical calculations were performed on either an IBM 360-75 or an IBM 370-165 computer.

Method of Deriving Attribute-Requirement Estimates of OAI Work Elements

In order to derive attribute-requirement estimates for OAI work elements, a mean rating was computed on each attribute for each OAI work element which had been rated on the attribute. This procedure yielded a profile of 103 attribute means for each of the 581 OAI items. (As mentioned earlier, the 41 Mental Activities items did not receive attribute ratings.) The mean was selected as the measure of central tendency because it is easier to deal with statistically than other measures of central tendency. Furthermore, it was shown in a previous study that mean attribute-requirement estimates of work elements correlated .97 with median attribute-requirement estimates of those same work elements (Mecham and McCormick, 1969a).

Method of Estimating Inter-rater Reliability

An analysis-of-variance procedure (Winer, 1962) was used to compute reliability coefficients for each of the 103 ARI attributes; observations consisted of attribute ratings for the 581 OAI work elements. Four coefficients of reliability were computed for each attribute. The first two coefficients were computed from unadjusted data. One, the intraclass correlation coefficient, represents the reliability for a single hypothetical rater and is approximately equal to the mean intercorrelation between all possible pairs of raters for a particular attribute. The second coefficient represents the reliability of the mean ratings across all raters for the attribute in question. This latter reliability coefficient can be interpreted as the approximate correlation which would be obtained if the mean ratings of this study were correlated with the mean ratings obtained in another study using a new sample of raters (i.e., a sample of the same size drawn randomly from the same population). The last two reliability coefficients were adjusted for differences in the raters' frames of reference. Although these coefficients correspond to the first two coefficients, they are usually higher, since they contain no error due to systematic differences in rating tendencies.

Factor Analyses of Work Elements Within Six Sections of the OAI

A factor-analytic procedure was applied to the attribute profiles of the OAI work elements in order to derive a set of basic work dimensions. Since the selected factor-analysis program would not handle the large number of variables in this study, the work elements were divided into six separate *a priori* groups corresponding to the following OAI sections: (1) Information Received (115 elements); (2) Physical Work Behavior (191 elements); (3) Representational Work Behavior (39 elements); (4) Interpersonal Work Behavior (32 elements); (5) Work Goals

(112 elements); and (6) Work Context (60 elements). Three groups of OAI items were excluded from the factor analyses. It was felt that the Sensory Channel and Incentives items (17 and 10 items, respectively) should be omitted, because they represent basic psychological dimensions which might not combine meaningfully with the more specific work elements. The Mental Activities category of the OAI (41 items) was also excluded from factor analysis, since, as mentioned earlier, its elements were not rated on the ARI attributes. In addition, five elements of an open-ended nature (19t, 40t, 46t, 66t, and 95t) were omitted from the second analysis (Physical Work Behavior). Thus, of the original 622 OAI items, a total of 549 were included in the sectional factor analyses.

In all six factor analyses, a principal components solution was employed with 1.0's entered in the main diagonal of the correlation matrix. Eigenvalues were computed for the resulting factors and then plotted for each section. The Scree Test (Cattell, 1966a) was then applied to these plots to determine the number of factors to rotate in each analysis. Next, these factors were rotated obliquely for simple loadings (Gennrich and Sampson, 1966). Kaiser normalization was used for rotation. In accordance with Cattell's (1966b) arguments, the main reasons for the use of oblique rotations in this study were: (1) there was no reason to eliminate the possibility of correlated factors; (2) an oblique rotation permits an orthogonal solution, while the reverse is not true; and (3) an oblique rotation, in many cases, leads to more interpretable factors. After rotation, factor scores were computed for each attribute on all of the factors.

Methods of Estimating Factorial Stability

There is some danger in accepting a factorial structure without first testing its replicability, since, as demonstrated by Armstrong and Soelberg (1968), it is possible to obtain interpretable factors from randomly generated data. For this reason, analyses were performed to determine the invariance of the factors obtained in the present study. These analyses involved the following three steps: (1) the attribute ratings were randomly divided into two samples; (2) the previously described factor analyses were performed separately on each sample; and (3) the resulting factors were compared across samples. The details of these steps are described below.

In the first step, the 13 raters were divided into the following three categories: (1) raters who had rated the OAI items on all 103 ARI attributes and who were permanently employed on the research project; (2) temporary (hourly paid) raters who had rated OAI items on all 103 attributes; and (3) raters (both temporarily and permanently employed) who had not rated the OAI items on the complete set of attributes. Under this grouping arrangement, there were four raters in the first category, two in the second, and seven in the third. The ratings in the third category were combined to form three complete sets of ratings (i.e., three "pseudoraters") and one incomplete set containing ratings on 54 attributes. Next, the sets of ratings (i.e., raters and "pseudoraters") in each of the three categories were equally divided on a random basis into two separate samples. Thus, one sample contained five complete sets of ratings (i.e., ratings of the OAI items on all 103 ARI attributes), and the second sample contained approximately four and one-half sets of ratings. This procedure ensured that the data for the two samples were obtained from comparable raters.

In the second step of the analysis of factorial stability, the previously described factor-analytic procedures were applied separately to each of the two samples. Thus, six factor analyses were carried out within each sample, and the same numbers of factors that were rotated in the original analyses were rotated in each of the two samples. Factor scores were computed for each attribute on all rotated factors.

The third and final step in the stability analysis consisted of comparing pairs of rotated factors across the two samples, within each of the six OAI sections. Two indices were used in these comparisons: (a) Tucker's (1951) coefficient of congruence, an index of relationship between factor loadings; and (b) the Pearson product-moment correlations between factor scores for attributes. These indices were computed between all possible pairs of factors across the two samples, within each OAI section. For example, 324 coefficients of congruence were computed for the first section (Information Received), in which 18 factors were rotated. Factors were matched across samples based on the highest coefficients.

Derivation of Higher-Order Factors

As noted earlier, the original factor analyses were carried out within each of six OAI sections. These six analyses yielded a total of 77 factors (described under Results, pp. 80-88). It was decided that the resulting factors should themselves be factor analyzed in order to (1) reduce the redundancy among these factors, (2) reduce the factors to a more manageable number, and (3) produce factors which (hopefully) could be interpreted in terms of the information-processing paradigm shown in Figure 1 (excluding the Mental Activities component). The data matrix for the overall, or "higher-order," factor analysis contained scores for 102 ARI attributes on the 77 first-order factors.[1] The factor-analytic procedures were the same as those used in the original factor analyses--i.e., a principal components solution followed by oblique rotations.

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[1] One of the original 103 attributes (Item 96 in the ARI) was excluded from the first-order factor analyses because of its low inter-rater reliability.

RESULTS

The presentation of the results is organized in accordance with the preceding description of the analyses.

Mean Attribute-Requirement Profiles

The mean attribute-requirement profiles of the OAI work elements are presented in Appendix C. As noted earlier, the mean was selected as the measure of central tendency, instead of the median, because (a) it is easier to compute, (b) it is more frequently used in statistical procedures, and (c) previous research has shown high correlations between mean and median attribute profiles of activity statements (Mecham and McCormick, 1969a). The weight of each attribute on an OAI work element can be interpreted as an estimate of the "relevance" of the attribute to the OAI element when that element is a "very significant" part of a job (see ARI instructions, Appendix B).

Reliabilities of Attribute Ratings

Indices of inter-rater agreement on the attribute ratings were computed for each of the 103 ARI attributes, treating the 581 OAI work elements as cases and individual raters as variables (Winer, 1962). The four different reliability estimates obtained for each attribute are shown in Appendix D. Table 1 contains a frequency distribution of the unadjusted reliability coefficients for mean ratings. The median of this distribution falls in the .90 - .94 interval. Each coefficient is an estimate of the reliability of the mean ratings of 581 OAI work elements on a single ARI attribute. The unadjusted coefficient for mean ratings was selected as the most representative reliability index, instead of the coefficient adjusted for differences in rating tendencies, since such differences affect the mean attribute profiles (especially with small groups of raters). The data for one attribute, Moral Values (ARI item 96), were excluded from the subsequent factor analyses because of an unacceptably low reliability coefficient.

Factors Derived Within Six Sections of the OAI

The following numbers of factors were rotated in the six sections of the OAI: (1) Information Received, 18 factors; (2) Physical Work Behavior, 18 factors; (3) Representational Work Behavior, 7 factors; (4) Interpersonal Work Behavior, 6 factors; (5) Work Goals, 16 factors; and (6) Work Context, 12 factors. A total of 77 factors was obtained. The factor correlation matrices for the six sectional analyses are presented in Appendix E. Tables 2 through 7 present the rotated factor loadings obtained from the six analyses. In accordance with Guilford's (1954) suggested criterion, only loadings of .29 or greater were considered significant; loadings lower than .29 were excluded from Tables 2 through 7. The factors represented in these tables are described in the following paragraphs.

Table 1. Frequency Distribution of the Unadjusted Coefficients of Reliability for the Mean Ratings of 581 OAI Work Elements on 103 Human Attributes

Coefficient of Reliability	Frequency	Proportion	Cumulative Proportion
.95 - 1.00	16	.155	.999
.90 - .94	42	.408	.844
.85 - .89	27	.262	.436
.80 - .84	12	.116	.174
.75 - .79	2	.019	.058
.70 - .74	0	.000	.039
.65 - .69	2	.019	.039
.60 - .64	1	.010	.020
.55 - .59	0	.000	.010
.50 - .54	0	.000	.010
.00 - .49	1	.010	.010

Dimensions of Information Received

From the principal components analysis of work elements in the Information Received section of the OAI, 18 factors were extracted and rotated. These factors accounted for 91 percent of the total variance, and all 18 were interpreted. The work elements with substantial loadings on the Information Received factors are presented in Table 2.

Dimension A-1: Information concerning mechanical devices/processes. This dimension centers around information concerning the functioning of mechanical devices. Most important is direct information received from these devices, with a secondary emphasis on indirect or written information.

Table 2. Dimensions of Information Received

	Job Dimension	Rotated Loading[a]
Dimension A-1:	Information concerning mechanical devices/processes.	
7i	Mechanical motion	.94
5i	Control or regulation of mechanical devices	.93
3i	State of preventive maintenance	.91
1i	Overall state of mechanical fastening	.89
4i	Malfunction of specific parts or components	.89
6i	Interrelations of mechanical parts	.84
2i	Quantity and quality of machine output in relation to standards of performance or quality control standards	.69
9i	Displays	.58
11i	Written material pertaining to mechanical devices	.46
10i	Mechanical test equipment and measuring devices	.37
12i	Written material pertaining to mechanical or physical principles	.32
8i	Mechanical drawings	.30
17i	Regulation and control of electrical and electronic systems	.30
24i	Interrelation, position, and fit of connected parts or objects	.30
14i	State of preventive maintenance	.29
Dimension A-2:	Technical written information.	
12i	Written material pertaining to mechanical or physical principles	.80
60i	Written material pertaining to the environment	.78
32i	Written material pertaining to basic principles of structures	.77
23i	Written material pertaining to basic principles of electricity/electronics	.71
49i	Technical written material concerning physical or chemical properties of materials or substances	.70

Table 2 (continued)

	Job Dimension	Rotated Loading[a]
Dimension A-2: (continued)		
79i	Content or meaning	.66
11i	Written material pertaining to mechanical devices	.61
31i	Written material pertaining to interrelated parts and objects	.60
68i	Written material pertaining to art or decorations	.56
48i	Nontechnical written material pertaining to materials or substances	.53
22i	Written material pertaining to electrical or electronic devices	.51
100i	Contracts and other legal written information	.50
78i	Written material pertaining to biology, health, or nutrition	.44
99i	Written business information	.43
114i	Descriptions of events involving people	.39
84i	Complexity of numbers	.32
82i	Grammar or expression	.30
85i	Signs and symbols representing numerical operations and relations	.29
Dimension A-3: Health information.		
70i	State of health and hygiene	.93
73i	Materials and devices related to biology or health	.93
69i	Dietary needs or deficiencies	.88
77i	Verbal information concerning symptoms, feelings, activities, requests	.86
71i	Miscellaneous biological characteristics of people or animals	.85
76i	Measuring or testing devices	.85
75i	Pictures or diagrams	.84

Table 2 (continued)

	Job Dimension	Rotated Loading[a]
Dimension A-3: (continued)		
78i	Written material pertaining to biology, health, or nutrition	.80
72i	Gestures, sounds, or facial expressions indicating physical feelings such as pain	.76
74i	Materials, objects, and devices related to nutrition	.67
101i	Physical condition of people	.65
109i	Emergency situations involving people	.39
43i	Hazard	.34
112i	Descriptions of individuals	.30
Dimension A-4: Information pertaining to aesthetic appearance and arrangement.		
62i	Form or shape of objects	.63
63i	Location of objects or people in space for aesthetic purposes	.55
54i	Celestial objects and events	.48
61i	Colors and color schemes	.45
66i	Sketches, models, or other graphic information	.40
34i	Surface characteristics	.38
27i	Interrelation or arrangement of unconnected objects within a prescribed space or area	.35
55i	Weather and atmospheric conditions	.29
Dimension A-5: Numerical/symbolic information.		
86i	Frequency of numerical information	.93
87i	Tables and graphs	.92
85i	Signs and symbols representing numerical operations and relations	.88

Table 2 (continued)

	Job Dimension	Rotated Loading[a]
Dimension A-5: (continued)		
88i	Information in numerical form concerning characteristics of things, events, or people	.88
84i	Complexity of numbers	.87
97i	Numerical business information	.85
98i	Business graphs, charts, or diagrams	.82
115i	Tables, diagrams, graphs, etc., conveying information about people	.82
59i	Tables and graphs	.75
90i	Special symbols	.57
93i	Money or other medium of exchange	.46
92i	Numerical or coded information	.44
Dimension A-6: Materials information.		
39i	Consistency	.89
41i	Elasticity	.89
35i	Weight	.87
37i	Physical state	.87
40i	Malleability/ductility	.86
44i	Chemical reactivity	.86
42i	Hardness	.85
36i	Flavor, odor, or edibility	.83
38i	Fragility or strength	.82
43i	Hazard	.82
45i	Conductivity	.74
47i	Symbol systems pertaining to materials or substances	.74
33i	Overall quality	.73
34i	Surface characteristics	.67
46i	Materials measuring and testing devices	.57

Table 2 (continued)

	Job Dimension	Rotated Loading[a]
Dimension A-6: (continued)		
48i	Nontechnical written material pertaining to materials or substances	.51
49i	Technical written material concerning physical or chemical properties of materials or substances	.51
74i	Materials, objects, and devices related to nutrition, sanitation, or food preparation	.35
25i	Connections and fastening of objects and parts	.32
26i	Appearance of assembled or constructed objects in relation to prescribed standards	.29
Dimension A-7: Business/sales information.		
94i	Merchandise	.95
95i	Advertising materials	.81
93i	Money or other medium of exchange	.74
96i	Customers and clients	.72
99i	Written business information	.51
113i	Characteristics of groups of people and people in general	.42
97i	Numerical business information	.37
100i	Contracts and other legal written information	.35
107i	Mood, attitudes, feelings, intentions, desires, etc.	.35
98i	Business graphs, charts, or diagrams	.33
Dimension A-8: Environmental information.		
51i	Soil	.91
50i	Plant life	.84
53i	Water conditions	.82
52i	Terrain and geological features	.79
56i	Environmental emergencies	.79

Table 2 (continued)

	Job Dimension	Rotated Loading[a]
Dimension A-8: (continued)		
55i	Weather and atmospheric conditions	.68
103i	Grooming and appearance of animals	.45
54i	Celestial objects and events	.41
105i	Performance of animals	.37
58i	Environmental test equipment and measuring devices	.36
59i	Tables and graphs	.30
Dimension A-9: Spatial information.		
29i	Drawings, patterns, or diagrams pertaining to the layout or placement of unconnected parts or objects	.89
89i	Diagrams, drawings, or maps	.83
28i	Drawings, plans, or diagrams pertaining to the arrangement, placement, and fastening of interconnected parts	.81
8i	Mechanical drawings	.76
57i	Charts or maps	.72
27i	Interrelation or arrangement for unconnected objects within a prescribed space or area	.62
18i	Electrical/electronic schematics and diagrams	.57
66i	Sketches, models, or other graphic information	.57
24i	Interrelation, position, and fit of connected parts or objects	.53
30i	Measuring and layout devices	.42
75i	Pictures or diagrams	.38
63i	Location of objects or people in space for aesthetic purposes	.32
26i	Appearance of assembled or constructed objects in relation to prescribed standards	.31
54i	Celestial objects and events	.30
62i	Form or shape of objects	.29

Table 2 (continued)

	Job Dimension	Rotated Loading^a
Dimension A-10:	Information pertaining to human events and characteristics.	
113i	Characteristics of groups of people and people in general	-.30
54i	Celestial objects and events	-.32
56i	Environmental emergencies	-.32
107i	Mood, attitudes, feelings, intentions, desires, etc.	-.43
114i	Descriptions of events involving people	-.43
110i	Habitat of people	-.65
111i	Group settings	-.69
109i	Emergency situations involving people	-.79
108i	Crowd situations	-.87
Dimension A-11:	Electrical/electronic information.	
23i	Written material pertaining to basic principles of electricity/electronics	-.57
45i	Conductivity	-.57
22i	Written material pertaining to electrical or electronic devices	-.65
18i	Electrical/electronic schematics and diagrams	-.66
21i	Electrical/electronic test equipment and measuring devices	-.66
15i	Interrelations or interconnections of electrical or electronic parts	-.75
13i	Overall performance of electrical/electronic devices in relation to standards	-.77
17i	Regulation and control of electrical and electronic systems	-.77
20i	Displays conveying electrical/electronic information	-.77
14i	State of preventive maintenance	-.81

Table 2 (continued)

	Job Dimension	Rotated Loading[a]
Dimension A-11: (continued)		
16i	Malfunctions of specific electrical/electronic parts or components	-.83
19i	Electrical/electronic symbols and codes	-.87
Dimension A-12: Clerical information.		
83i	Proper classification	.98
80i	Correspondence of contents of one manuscript or list with contents of another	.96
81i	Format, punctuation, or spelling	.92
82i	Grammar or expression	.82
91i	Verbal information	.55
90i	Special symbols	.43
100i	Contracts and other legal written information	.37
79i	Content or meaning	.33
99i	Written business information	.32
92i	Numerical or coded information	.31
48i	Nontechnical written material pertaining to materials or substances	.30
Dimension A-13: Information from measuring and testing devices.		
58i	Environmental test equipment and measuring devices	.71
10i	Mechanical test equipment and measuring devices	.65
30i	Measuring and layout devices	.65
21i	Electrical/electronic test equipment and measuring devices	.55
46i	Materials measuring and testing devices	.54
76i	Measuring or testing devices	.43

Table 2 (continued)

	Job Dimension	Rotated Loading[a]
Dimension A-13: (continued)		
9i	Displays	.38
2i	Quantity and quality of machine output in relation to standards of performance or quality control standards	.35
Dimension A-14:	Information pertaining to the performance of humans and animals.	
104i	Physical performance of people	.97
105i	Performance of animals	.80
106i	Knowledge, verbal performance, and experience	.66
112i	Descriptions of individuals	.47
113i	Characteristics of groups of people and people in general	.35
111i	Group settings	.34
Dimension A-15:	Art/decorative information.	
64i	Music	.93
67i	Musical notation	.86
65i	Facial expressions, body movements, speech or voice characteristics of a performer	.77
68i	Written material pertaining to art or decorations	.54
63i	Location of objects or people in space for aesthetic purposes	.38
66i	Sketches, models, or other graphic information	.36
61i	Colors and color schemes	.32
Dimension A-16:	Oral/auditory information.	
92i	Numerical or coded information	.68
91i	Verbal information	.42

Table 2 (continued)

	Job Dimension	Rotated Loading[a]
Dimension A-17: Structural information.		
38i	Fragility or strength	-.32
32i	Written material pertaining to basic principles of structures	-.32
31i	Written material pertaining to interrelated parts and objects	-.33
24i	Interrelation, position, and fit of connected parts or objects	-.44
26i	Appearance of assembled or constructed objects in relation to prescribed standards	-.57
25i	Connections and fastening of objects and parts	-.66
Dimension A-18: Personal service information.		
107i	Mood, attitudes, feelings, desires, etc.	-.33
101i	Physical condition of people	-.38
61i	Colors and color schemes	-.49
103i	Grooming and appearance of animals	-.54
102i	Grooming, style, and poise of people	-.84

[a] Rotated loadings less than .29 were omitted.

Dimension A-2: Technical written information. All of the items loading substantially on this factor pertain to written information, mostly of a technical nature. The information ranges from that pertaining to mechanics, electricity, structures, and chemical properties, to information pertaining to business, biology, and the environment.

Dimension A-3: Health information. Items loading substantially on this factor are primarily concerned with the state of health or biological condition of people. Important are items such as materials and devices related to biology or health, state of health and hygiene, dietary needs, and physical condition of people. Also important are the different indications of the state of health and hygiene of people.

Dimension A-4: Information pertaining to aesthetic appearance and arrangement. The items loading substantially on this factor deal primarily with information concerning the aesthetic appearance or spatial arrangement of objects. A strong emphasis on perception is indicated by the fact that all but one of the items pertain to direct information.

Dimension A-5: Numerical/symbolic information. This factor emphasizes numerical and other types of symbolic input. Items with high loadings pertain to numerical descriptions of things and events, signs and symbols, complexity of numbers, tables and graphs, and frequency of numerical information. Some business and environmental items (93i, 97i, 98i, 59i) also load on this factor, along with items concerning indirect information about people. Most of these latter items deal with information of a numerical or symbolic nature.

Dimension A-6: Materials information. Items pertaining to such basic material and chemical properties as elasticity, ductility, chemical reactivity, conductivity, etc., are combined with items indicating such physical properties as weight, physical state, overall quality, surface characteristics, etc., to form a well-defined materials factor. The loadings on two spatial/structural items (25i, 26i) are consistent with this interpretation, since information about the physical and chemical properties of materials is involved in the fastening, connecting, or assembling of objects.

Dimension A-7: Business/sales information. This factor concerns different aspects of business and sales information. It includes direct (on-the-scene) as well as indirect (semantic and symbolic) types of information. Two items concerning attitudes, feelings, and characteristics of people also load on this factor, which is understandable in view of the importance of this information in the sales field. With the exception of these two items, all items loading on this factor were contained in the OAI section titled Business/Sales Information.

Dimension A-8: Environmental information. This dimension emphasizes a variety of environmental variables, including all of the items dealing with direct environmental information and two items dealing with indirect environmental information. The only significant elements falling outside the OAI Environmental Information group are two items pertaining to animals (103i and 105i).

Dimension A-9: Spatial information. Work elements from several different areas of Information Received are combined in this dimension. Most of these items pertain to the positions and relationships of figures or objects. They include information from diagrams, charts, drawings, and sketches, as well as a few items (24i, 26i, 27i, and 63i) dealing with direct information concerning the arrangement and position of objects. There seems to be an underlying emphasis on the visualization of spatial arrangements.

Dimension A-10: Information pertaining to human events and characteristics. This dimension is comprised of items describing human events, characteristics, and environment. All but two of these items (113i and 114i) deal with direct (on-the-scene) information.

Dimension A-11. Electrical/electronic information. This factor is defined by work elements which convey direct and indirect information concerning electrical and electronic devices and systems. With the exception of Item 45i (conductivity), the variables comprising this factor are contained exclusively in the OAI group titled Electrical and Electronic Information.

Dimension A-12: Clerical information. The items loading most heavily on this factor include: proper classification (including filing); comparison of lists for accuracy; grammar; and format, punctuation, or spelling. All of these work elements are involved in clerical tasks. Other items loading on this factor--such as special symbols, verbal and business information, content or meaning, and items concerning written information--also lend themselves to a clerical interpretation.

Dimension A-13: Information from measuring and testing devices. All of the work elements in this group, except one, pertain directly to information from various types of testing or measuring equipment. The other item in this factor (2i) deals with the comparison of machine output to quality and quantity standards, a type of information that often involves measurement and testing.

Dimension A-14: Information pertaining to the performance of humans and animals. The items loading most heavily on this factor describe direct information concerning the performance by humans and animals of various physical and mental tasks. All of the items for this factor are contained in the OAI group titled Information About People and Animals.

Dimension A-15: Art/decorative information. All of the items in this dimension belong to the OAI group titled Art/Decorative Information. The factor seems to be most heavily oriented toward music and the performing arts, with lesser loadings on spatial and color arrangements.

Dimension A-16: Oral/auditory information. The two items defining this factor both fall under the OAI heading of Oral/Auditory Information. These work elements deal with semantic and symbolic information received orally by the worker.

Dimension A-17: Structural information. The items in this factor are related to the construction or assembly of parts and objects. Four of the items pertain to direct information from constructed or assembled objects and parts, while two items (31i and 32i) deal with written information about the interrelation of parts and objects and the principles of structure.

Dimension A-18: Personal service information. This dimension emphasizes information pertaining to personal service, especially in relation to the appearance of others. For example, the items concerning information about color and color schemes might pertain to tailoring and cosmetology; the items dealing with grooming and physical condition are also relevant to appearance. Information regarding the emotional state of others, another critical variable in personal service, is also important to this factor.

Dimensions of Physical Work Behavior

Following the principal components analysis of the work elements in this section, 18 factors were rotated. These 18 factors accounted for 91 percent of the total variance. All of these factors were interpreted and are presented in Table 3.

Dimension B-1: Tool usage. This dimension is characterized by items related to both non-powered and portable powered tool usage. Most forms of material parting, joining, forming, and shaping are represented, as well as earth working and surface preparation. A high level of manual dexterity and eye-hand coordination are required, as indicated by the factor scores for these attributes. The most heavily loading items deal with cutting and abrasion.

Dimension B-2: Use of measuring devices. The items loading on this factor emphasize the use of measuring and layout devices, along with the performance of measuring, testing, and inspecting activities. The items dealing with basic measuring devices (those measuring weight, volume, physical extent, electricity, time, pressure, temperature, etc.) load the highest on this factor.

Dimension B-3: Mechanized equipment operation. This dimension includes all of the OAI work elements involving mechanized equipment operation, as well as items related to physical coordination and the use of control devices. The small but significant loading on the sporting equipment item is probably related to the emphasis on physical coordination.

Dimension B-4: Medical/veterinary activities. This dimension clearly emphasizes the medical treatment of people and animals. Several

Table 3. Dimensions of Physical Work Behavior

	Job Dimension	Rotated Loading[a]
Dimension B-1:	Tool usage.	
22t	Cutting by shearing (portable powered)	.60
35t	Grinding (portable powered)	.60
23t	Cutting by blade (portable powered)	.59
24t	Cutting by abrasion (portable powered)	.59
21t	Cutting by sawing (portable powered)	.58
33t	Perforating/boring (portable powered)	.57
32t	Scraping (portable powered)	.56
36t	Combining/separating (portable powered)	.56
2t	Cutting by shearing (non-powered)	.55
13t	Perforating/boring (non-powered)	.55
4t	Cutting by abrasion (non-powered)	.54
1t	Cutting by sawing (non-powered)	.53
31t	Abrading/polishing (portable powered)	.53
34t	Shaping (portable powered)	.53
25t	Cutting by heat (portable powered)	.52
3t	Cutting by blade (non-powered)	.49
37t	Earth working (portable powered)	.49
10t	Scraping (non-powered)	.48
12t	Shaping (non-powered)	.48
8t	Liquid application/coating (non-powered)	.45
9t	Abrading/polishing (non-powered)	.45
28t	Stitching (portable powered)	.45
30t	Liquid application/coating (portable powered)	.42
11t	Forming (non-powered)	.41
29t	Mechanical fastening (portable powered)	.41
27t	Bonding (portable powered)	.40
14t	Handling (non-powered)	.39
16t	Earth working (non-powered)	.38

Table 3 (continued)

	Job Dimension	Rotated Loading[a]
Dimension B-1: (continued)		
26t	Fusion (portable powered)	.37
6t	Mechanical fastening (non-powered)	.35
15t	Cleaning (non-powered)	.35
29j	Non-powered hand tools and work equipment	.35
5t	Bonding/sealing (non-powered)	.33
7t	Stitching/wiring (non-powered)	.33
38t	Sporting equipment (portable powered)	.33
31a	Laying/covering (work activities)	.33
39t	Medical equipment (portable powered)	.32
17t	Sporting equipment (non-powered)	.30
Dimension B-2:	Use of measuring devices.	
85t	Weight/volume	.96
90t	Motion/force	.96
89t	Time	.95
88t	Pressure/temperature	.93
86t	Physical extent	.92
91t	Physical characteristics	.90
48a	Measuring/counting	.85
87t	Electrical	.82
92t	Work layout	.60
33j	Professional, measurement, and scientific instruments	.58
94t	Navigation/guidance/detection	.56
50a	Testing	.49
93t	Optical devices	.47
49a	Inspecting	.30
34j	Equipment/systems, not elsewhere defined	.30

Table 3 (continued)

	Job Dimension	Rotated Loading[a]
Dimension B-3:	Mechanized equipment operation.	
69t	Large highway vehicles	.97
70t	Medium/light highway vehicles	.96
72t	Rail vehicles	.94
67t	Heavy equipment	.92
68t	Medium/light equipment	.92
71t	Off-road vehicles	.92
73t	Air vehicles	.92
74t	Water vehicles	.92
26a	Driving/operating	.84
3a	Tracking	.65
76t	People conveyors	.59
81t	Hand-operated (discrete controls)	.58
83t	Hand-operated (continuous controls)	.58
82t	Foot-operated (discrete controls)	.57
84t	Foot-operated (continuous controls)	.57
30j	Transportation and mechanized equipment	.56
2a	Control precision	.50
7a	Reaction time	.50
75t	Material conveyors	.49
8a	Multilimb coordination	.39
1a	Eye-hand coordination	.36
17t	Sporting equipment (non-powered)	.33
Dimension B-4:	Medical/veterinary activities.	
53a	Physical treatment, excluding surgery	.98
52a	Examining	.95
55a	Applying medicines	.92
18t	Medical devices (non-powered)	.80

Table 3 (continued)

	Job Dimension	Rotated Loading[a]
Dimension B-4 (continued)		
54a	Surgical treatment	.78
39t	Medical equipment, powered (portable powered)	.74
3j	People	.74
18j	Medical materials	.73
2j	Animals and marine life	.69
51a	Handling	.61
20t	Precision in hand tool usage (non-powered)	.39
41t	Precision in portable powered tool/equipment usage	.31
Dimension B-5: Strenuous work activities.		
19a	General body strength	.98
22a	Dynamic strength	.90
18a	Finger/hand/arm strength	.87
21a	Endurance/stamina	.85
20a	Explosive strength	.84
45a	Earth working	.48
12a	Running	.40
45t	Non-powered wheeled equipment (portable)	.35
16a	Kneeling/stooping/crawling	.35
44a	Material and object handling	.35
16t	Earth working (non-powered)	.34
17a	Lying	.29
Dimension B-6: Construction work.		
38j	Outdoor passageways and structures, other than buildings	.90
21j	Pre-fabricated construction components of wood and related materials	.89

Table 3 (continued)

Job Dimension		Rotated Loading[a]
Dimension B-6: (continued)		
35j	Exteriors of large buildings	.89
36j	Exteriors of small buildings	.88
20j	Pre-fabricated construction components of metal and concrete	.87
37j	Interiors of buildings	.84
33a	Constructing/building	.57
41j	Miscellaneous wooden products	.53
26j	Miscallaneous wooden parts, excluding construction components	.52
39j	Man-made land features	.51
11j	Earth materials	.49
37a	Material forming	.48
25j	Miscellaneous metal parts, excluding mechanical and electrical parts and construction components	.48
40j	Miscellaneous metal products, not elsewhere defined	.48
10j	Lumber and related materials	.45
9j	Metal, excluding precious metals	.42
22j	Mechanical parts	.39
24j	Screws, non-electric wire, and wire products	.38
34a	Assembling	.35
43t	Supporting (portable non-powered)	.33
36a	Material shaping	.31
12j	Rubber, plastic, and related synthetic materials	.31
32a	Installing/connecting	.30
42j	Rubber and plastic products	.29

Table 3 (continued)

	Job Dimension	Rotated Loading[a]
Dimension B-7: Material processing.		
7j	Non-processed or minimally-processed animal materials	-.30
42j	Rubber and plastic products	-.30
38a	Surface finishing	-.31
42a	Heat or pressure treating, except in forming	-.32
8j	Non-processed or minimally-processed plant materials, other than wood	-.32
39a	Combining/separating	-.33
41a	Electrically treating	-.38
9j	Metal, excluding precious metals	-.44
11j	Earth materials	-.44
16j	Textile and leather materials, including synthetics	-.44
10j	Lumber and related materials	-.45
5j	Non-processed geological materials	-.48
18j	Medical materials	-.48
6j	Non-processed woods	-.51
40a	Chemically treating	-.62
17j	Paper and paper materials	-.63
12j	Rubber, plastic, and related synthetic materials	-.68
13j	Surface preparation and bonding substances	-.69
14j	Chemical and petroleum materials and substances	-.79
Dimension B-8: Eye-hand versus eye-foot coordination.		
84t	Foot-operated (continuous controls)	.36
82t	Foot-operated (discrete controls)	.35
47a	Monitoring	-.31

Table 3 (continued)

	Job Dimension	Rotated Loading[a]
Dimension B-8: (continued)		
49a	Inspecting	-.34
38t	Sporting equipment (portable powered)	-.36
3a	Tracking	-.36
17t	Sporting equipment (non-powered)	-.42
1a	Eye-hand coordination	-.42
Dimension B-9:	Physical activities associated with personal service and treatment.	
15a	Sitting	.81
14a	Standing	.79
11a	Walking	.57
3j	People	.41
80t	Foot-operated (continuous settings)	.36
78t	Foot-operated (discrete settings)	.33
76t	People conveyors	.31
17a	Lying	.31
Dimension B-10:	Agriculturally related activities.	
37t	Earth working (portable powered)	-.32
45t	Non-powered wheeled equipment (portable)	-.39
39j	Man-made land features	-.49
8j	Non-processed or minimally-processed plant materials, other than wood	-.55
7j	Non-processed or minimally-processed animal materials	-.57
2j	Animals and marine life	-.59
4j	Terrain features	-.67
1j	Plant life, including crops, trees, and shrubs	-.82

Table 3 (continued)

	Job Dimension	Rotated Loading[a]
Dimension B-11: Mechanical and electrical maintenance and repair.		
30a	Diagnosing/troubleshooting	.84
32j	Electrical/electronic equipment and components	.62
27a	Repairing	.61
50a	Testing	.61
28a	Servicing	.57
29a	Adjusting/tuning	.55
31j	Machines and mechanical components, excluding transportation and mechanized equipment	.51
41a	Electrically treating	.49
23j	Electrical and electronic parts and components	.45
47a	Monitoring	.43
49a	Inspecting	.40
30j	Transportation and mechanized equipment	.40
32a	Installing/connecting	.36
34j	Equipment/systems, not elsewhere defined	.33
22j	Mechanical parts	.31
33j	Professional, measurement, and scientific instruments	.31
29j	Non-powered hand tools and work equipment	.29
Dimension B-12: Stationary equipment operation.		
63t	Pressing	.82
49t	Cutting by shearing	.81
60t	Grinding	.81
50t	Cutting by blade	.80
57t	Abrading	.80
62t	Heat application	.80
58t	Drilling/perforating	.79

Table 3 (continued)

	Job Dimension	Rotated Loading[a]
Dimension B-12: (continued)		
48t	Cutting by abrasion	.78
47t	Cutting by sawing	.77
51t	Cutting by heat	.77
59t	Shaping	.77
64t	Combining/separating	.77
55t	Mechanical fastening	.75
61t	Forming	.75
53t	Bonding	.73
65t	Handling/supporting	.71
52t	Fusion	.70
54t	Stitching, knitting, and weaving	.70
56t	Liquid application/coating	.63
25a	Operating/controlling	.61
24a	Tending	.55
23a	Feeding/offbearing	.49
9j	Metal, excluding precious metals	.47
37a	Material forming	.44
36a	Material shaping	.42
79t	Hand-operated (continuous settings)	.39
10j	Lumber and related materials	.38
75t	Material conveyors	.35
80t	Foot-operated (continuous settings)	.35
17j	Paper and paper materials	.33
78t	Foot-operated (discrete settings)	.32
Dimension B-13: Joining/connecting activities.		
24j	Screws, non-electric wire, and wire products	.59
26t	Fusion (portable powered)	.54

Table 3 (continued)

Job Dimension		Rotated Loading[a]
Dimension B-13: (continued)		
27t	Bonding (portable powered)	.53
29t	Mechanical fastening (portable powered)	.52
28j	Miscellaneous parts of materials other than metal, wood, or textiles--such as rubber, plastic, fiberglass, ceramics, etc.	.52
5t	Bonding/sealing (non-powered)	.51
23j	Electrical and electronic parts and components	.51
6t	Mechanical fastening (non-powered)	.48
32a	Installing/connecting	.46
52t	Fusion (stationary machines and equipment)	.43
34a	Assembling	.42
28t	Stitching (portable powered)	.41
35a	Fiber/thread working	.41
7t	Stitching/wiring (non-powered)	.40
53t	Bonding (stationary machines and equipment)	.40
42t	Holding (portable non-powered)	.39
25j	Miscellaneous metal parts, excluding mechanical and electrical parts and construction components	.38
55t	Mechanical fastening (stationary machines and equipment)	.37
20j	Pre-fabricated construction components of metal and concrete	.35
26j	Miscellaneous wooden parts, excluding construction components	.34
54t	Stitching, knitting, and weaving (stationary machines and equipment)	.33
22j	Mechanical parts	.32
27j	Textile, leather, and related synthetic parts	.32

Table 3 (continued)

	Job Dimension	Rotated Loading[a]
Dimension B-14:	Precise control operations versus general body activities.	
*	Arm-hand manipulations without visual control	.57
*	Ear-hand or ear-foot coordination	.50
4a	Finger dexterity	.39
5a	Manual dexterity	.39
6a	Arm-hand steadiness	.38
2a	Control precision	.34
83t	Hand-operated (continuous controls)	.33
84t	Foot-operated (continuous controls)	.30
78t	Foot-operated (discrete settings)	.29
82t	Foot-operated (discrete controls)	.29
13a	Climbing	-.47
12a	Running	-.55
Dimension B-15:	Food processing.	
19j	Processed foods, which require further preparation--mixing, cooking, baking, etc.	.80
42a	Heat or pressure treating, except in forming	.59
39a	Combining/separating	.48
35a	Fiber/thread working	.36
40a	Chemically treating	.34
43a	Cleaning	.30
Dimension B-16:	General body coordination.	
9a	Balance	.83
10a	General body coordination	.75
13a	Climbing	.60
16a	Kneeling/stooping/crawling	.56

Table 3 (continued)

Job Dimension		Rotated Loading[a]
Dimension B-16: (continued)		
8a	Multilimb coordination	.53
17a	Lying	.48
11a	Walking	.45
12a	Running	.45
*	Arm-hand manipulations without visual control	.37
Dimension B-17: Unskilled machine-related activities.		
7a	Reaction time	.30
9t	Abrading/polishing (non-powered)	-.29
43t	Supporting (portable non-powered)	-.29
77t	Hand-operated (discrete settings)	-.29
28a	Servicing	-.29
10t	Scraping (non-powered)	-.30
24a	Tending	-.31
14t	Handling (non-powered)	-.32
43a	Cleaning	-.33
16t	Earth working (non-powered)	-.34
81t	Hand-operated (discrete controls)	-.38
15t	Cleaning (non-powered)	-.39
23a	Feeding/offbearing	-.45
44a	Material and object handling	-.49
Dimension B-18: Handicraft activities.		
15j	Art and craft materials	.86
43j	Apparel and finished textile and leather products	.71
44j	Fabricated products of miscellaneous materials, not elsewhere defined	.67
93t	Optical devices	.54

Table 3 (continued)

	Job Dimension	Rotated Loading[a]
Dimension B-18: (continued)		
4a	Finger dexterity	.48
38a	Surface finishing	.44
16j	Textile and leather materials, including synthetics	.42
20t	Precision in hand tool usage (non-powered)	.40
41j	Miscellaneous wooden products	.40
46a	Precision working	.39
6a	Arm-hand steadiness	.36
27j	Textile, leather, and related synthetic parts	.36
11t	Forming (non-powered)	.34
8t	Liquid application/coating (non-powered)	.31
35a	Fiber/thread working	.29

[a] Rotated loadings less than .29 were omitted.

*These items were later deleted from the OAI.

aspects of medical and veterinary treatment are included. Items dealing with the use of medical materials and devices also load on this factor, as well as precision in tool usage.

Dimension B-5: Strenuous work activities. This dimension includes elements involving the various types of strength and movement required in strenuous work activities, such as earth working and material handling.

Dimension B-6: Construction work. This dimension contains work elements pertaining to building activities. The range of structures included extends from small buildings (such as houses) to large buildings, bridges, and highways. Work on building exteriors and interiors, construction of outdoor structures, and associated earth-working activies are included. Because of the variety of objects acted upon and range of construction-related activities included, it appears that this factor encompasses all phases of construction, including interior finishing.

Dimension B-7: Material processing. This dimension is concerned with the treatment and processing of crude and processed materials. Items loading on this factor define both the types of materials to be treated or processed and the types of processing or treatment activities to be carried out (e.g., electrical, chemical, and heat treatment).

Dimension B-8: Eye-hand versus eye-foot coordination. This dimension is bi-polar, with negatively loading items emphasizing visual-hand coordination and positively loading items dealing with foot-control devices (which require eye-foot coordination). The two negatively loading items related to sporting equipment, as well as the negatively loading monitoring item, are consistent with this interpretation.

Dimension B-9: Physical activities associated with personal service and treatment. This factor includes four general body activities, in addition to items dealing with people as objects, foot-control devices, and people conveyors. This combination of work elements suggests a factor emphasizing the physical activities associated with personal service and treatment and other kinds of work in which people are acted upon.

Dimension B-10: Agriculturally related activities. This dimension is comprised of items dealing with plant and animal life, land features, nonprocessed plant and animal materials, and related equipment.

Dimension B-11: Mechanical and electrical maintenance and repair. The maintenance and repair of electrical and mechanical devices is clearly emphasized in this factor. Besides the substantial loadings of maintenance-related items, items pertaining to troubleshooting, installing, and electrical and mechanical parts load on this dimension.

Dimension B-12: Stationary equipment operation. The elements with the highest loadings on this factor include all of the OAI group titled Stationary Machines and Equipment. Also loading on this factor are items pertaining to activities and objects typically associated with stationary machine operation. Machine-related operations such as operating/controlling, tending, and feeding/offbearing are included, as well as items dealing with metal, lumber, paper, and setting devices.

Dimension B-13: Joining/connecting activities. This dimension emphasizes material joining activities, including fusion, bonding, mechanical fasterning, and stitching. The classes of objects involved include miscellaneous parts, electrical/electronic parts, mechanical parts, pre-fabricated construction components, wooden parts, textiles, leather, and synthetic parts. This factor would appear to be relevant to installation, assembly, fabrication, and possibly construction.

Dimension B-14: Precise control operations versus general body activities. This is a bi-polar dimension with the positively loading items emphasizing precise limb, hand, and finger movements in connection with the operation of hand- and foot-operated control devices; the two highest positive loadings suggest control operations without visual cues. The negatively loading items on this dimension define two general body activities (climbing and running) which are dependent upon vision.

Dimension B-15: Food processing. The items loading on this factor seem, for the most part, to be related to food processing. The relationship of the fiber/thread working element to this dimension is not clear, although it might be related to food processing within a general housekeeping context.

Dimension B-16: General body coordination. The items loading on this factor are concerned with the movement, position, and coordination of the body. All of the items in this dimension are contained in the OAI group titled General Physical Requirements.

Dimension B-17: Unskilled machine-related activities. The work elements defining this factor pertain to manual activities performed on and around machines. The machine-related activities include operating, tending, and servicing the equipment. Also included are several items dealing with non-powered tools and equipment. Although Item 7a (Reaction Time) received a substantial positive loading, as opposed to the negatively loading items characterizing this dimension, neither the magnitude of the loading nor the nature of the element seem to justify a bi-polar interpretation.

Dimension B-18: Handicraft activities. This factor deals with precise handwork involving arts and crafts materials, textiles, leather, wood, and miscellaneous materials. Activities such as forming, finishing, liquid application/coating, and fiber/thread working are included, with an emphasis on dexterity, steadiness, and precision.

Dimensions of Representational Work Behavior

The analysis of the Representational Work Behavior section of the OAI yielded seven dimensions which accounted for 85 percent of the total variance. All of these factors were interpreted and are presented in Table 4.

Dimension C-1: Verbal communication. Both written and oral communication are represented in the verbal communication factor. The written aspect of this dimension includes items ranging from informal writing to written communications containing technical terms. The items pertaining to oral communication include ordinary conversational English, dictating, and formal and technical language. Information processing activities related to communication (*i.e.*, analysis and synthesis) are also included in this dimension, as well as such miscellaneous aspects of communication such as precision of communication and various devices to transmit communication.

Dimension C-2: Mathematical/computational activities. This dimension emphasizes numerical elements such as calculating/computing, complexity of numerical information, and communication with numbers. Computing devices, ranging from electronic computers to hand devices, have high loadings on this factor, and three data-processing items (analyzing, compiling, and synthesizing) have small but significant loadings.

Dimension C-3: Clerical activities. This factor emphasizes activities typically associated with clerical work, such as transcribing, classifying, checking, and the use of keyboard devices.

Dimension C-4: Pictorial representation. Work elements loading on this dimension pertain to drawing, pictorial communication, and various associated devices, including drawing, still picture, audiovisual, and writing devices. Artistic and layout abilities appear to be an important aspect of the factor.

Dimension C-5: Communication by visual and auditory code. This dimension seems to involve communication by visual and auditory codes. The factor includes one item concerning communication by auditory code, and two items pertaining to devices which transmit audio-visual communications.

Dimension C-6: Interpersonal communication. The items in this dimension concern communication with others in situations ranging from the routine and personal to the structured and formal. It should be noted that the ARI attribute of social intelligence has a high score on this factor.

Dimension C-7: Abstract versus machine-aided representational activities. A distinction is made between representational activities requiring relatively high levels of thought versus the processing of information with the use of machines (*i.e.*, reproducing, transcribing, calculating, and recording). The negative loading on Item 18r

Table 4. Dimensions of Representational Work Behavior

	Job Dimension	Rotated Loading[a]
Dimension C-1:	Verbal communication.	
15r	Writing - level of difficulty	.97
19r	Formal, grammatically correct English	.86
21r	Foreign language	.84
17r	Speaking - level of difficulty	.83
20r	Technical terms	.76
38r	Analyzing	.76
39r	Synthesizing	.76
28r	Communication ratio	.75
14r	Writing	.73
29r	Communication precision	.65
16r	Speaking	.59
18r	Ordinary conversational English	.58
37r	Compiling	.53
7r	Voice transmission and storage devices	.34
1r	Writing devices	.30
Dimension C-2:	Mathematical/computational activities.	
27r	Complexity of numerical information communicated	.93
36r	Calculating/computing - level of difficulty	.93
9r	Hand computing devices	.91
12r	Uses computer programs which were written by others and which are entered on the computer by others	.91
13r	Writes computer programs for use by self or others and may or may not enter the programs on the computer	.88
35r	Calculating/computing	.88
10r	Mechanical computing devices	.82
26r	Communicates with numbers	.82

Table 4 (continued)

	Job Dimension	Rotated Loading[a]
Dimension C-2: (continued)		
11r	Data-card processing devices	.66
38r	Analyzing	.33
37r	Compiling	.32
39r	Synthesizing	.32
Dimension C-3: Clerical activities.		
34r	Classifying/categorizing	.95
32r	Comparing/checking	.94
33r	Copying/recording	.92
23r	Communicates with special written codes	.68
6r	Office reproducing devices	.51
3r	Keyboard devices	.49
37r	Compiling	.47
14r	Writing	.42
1r	Writing devices	.37
Dimension C-4: Pictorial representation.		
2r	Drawing devices	.88
25r	Communicates by drawing	.81
4r	Still picture devices	.75
1r	Writing devices	.52
8r	Audio-visual transmission and storage devices	.44
5r	Visual signaling devices	.33
24r	Communicates with auditory codes	-.29

Table 4 (continued)

	Job Dimension	Rotated Loading[a]
Dimension	C-5: Communication by visual and auditory code.	
22r	Signals by visual means	.82
5r	Visual signaling devices	.76
8r	Audio-visual transmission and storage devices	.55
24r	Communicates with auditory codes	.54
Dimension	C-6: Interpersonal communication.	
30r	Personalness of subject matter	.85
31r	Formality or structure of communicative interaction	.66
16r	Speaking	.48
24r	Communicates with auditory codes	.45
18r	Ordinary conversational English	.36
7r	Voice transmission and storage devices	.29
Dimension	C-7: Abstract versus machine-aided representational activities.	
25r	Communicates by drawing	.38
39r	Synthesizing	.38
38r	Analyzing	.34
1r	Writing devices	-.31
18r	Ordinary conversational English	-.34
8r	Audio-visual transmission and storage devices	-.35
10r	Mechanical computing devices	-.37
11r	Data-card processing devices	-.48
3r	Keyboard devices	-.53
6r	Office reproducing devices	-.54
7r	Voice transmission and storage devices	-.58

[a] Rotated loadings less than .29 were omitted.

(Ordinary conversational English) is consistent with this interpretation, since conversation would ordinarily be associated with the use of the negatively loading representational devices.

Dimensions of Interpersonal Work Behavior

Six factors from this section of the OAI were rotated and interpreted. These six factors, which accounted for 87 percent of the total variance, are presented in Table 5.

Dimension D-1: Conflict resolution. The first factor to emerge from this analysis emphasizes the various methods of resolving disagreements. The highest loading items include: discussing, mediating, negotiating, arbitrating, and pacifying. Among the lesser loading items are: advising persuading, socializing, and instructing. The item pertaining to consultants and advisors also has a substantial loading.

Dimension D-2: Supervising. This component clearly emphasizes supervisory activities. Included in addition to two supervision items, are evaluating, disciplining, organizing, and personnel actions.

Dimension D-3: Multiple-status interpersonal interaction. This dimension emphasizes interaction with people of varying levels of status. Items specifying the persons with whom the incumbent interacts include others with different job statuses (peers, supervisors, consultants, and subordinates) as well as clients or patients. The subordinate role is the most heavily emphasized, since it is represented by three highly loading items (3p, 4p, and 25p).

Dimension D-4: Medically related interpersonal activities. Treating, assisting, and serving/catering all load heavily on this dimension, with clients or patients as the relevant person types. The substantial loadings on assisting and serving/catering suggest a subordinate role (*e.g.*, a nurse-doctor relationship).

Dimension D-5: Sales/customer-service activities. All of the items loading on this factor combine into an easily interpretable dimension. The fundamentals of selling include interaction with customers or the general public and the use of sales techniques such as demonstrating, persuading, catering, giving and receiving information, and socializing and entertaining.

Dimension D-6: Teaching/instructing activities. The items loading on this factor define a well-formed dimension which specifies the activities engaged in by a teacher or instructor. The activities include: teaching/instructing, demonstrating, giving information to others, advising/counseling, evaluating, and obtaining information from others. The highest loading item defines the most relevant person type--students.

Table 5. Dimensions of Interpersonal Work Behavior

	Job Dimension	Rotated Loading[a]
Dimension D-1:	Conflict resolution.	
20p	Debating/discussing	.95
19p	Negotiating	.92
18p	Arbitrating	.90
22p	Mediating	.89
21p	Pacifying/placating	.85
29p	Consultants or advisors	.56
16p	Advising/counseling	.55
14p	Persuading	.49
24p	Socializing	.47
23p	Diverting/entertaining	.39
15p	Teaching/instructing	.38
12p	Obtaining information from others	.29
Dimension D-2:	Supervising.	
6p	General supervision	.95
5p	Close supervision	.93
9p	Organizing	.92
10p	Disciplining	.92
8p	Personnel actions	.89
7p	Evaluating	.83
27p	Subordinates	.77
4p	Surveillance received	.34
Dimension D-3:	Multiple-status interpersonal interaction.	
26p	Peers	.76
3p	Directions received - level of difficulty	.73
4p	Surveillance received - level of difficulty	.73

Table 5 (continued)

Job Dimension		Rotated Loading^a
Dimension D-3: (continued)		
25p	Superiors	.59
29p	Consultants or advisors	.56
28p	Clients or patients	.44
27p	Subordinates	.35
12p	Obtaining information from others	.34
11p	Giving information to others	.29
Dimension D-4: Medically related interpersonal activities.		
17p	Treating	.89
1p	Assisting	.73
2p	Serving/catering	.57
28p	Clients or patients	.36
Dimension D-5: Sales/customer-service activities.		
12p	Obtaining information from others	-.30
14p	Persuading	-.35
11p	Giving information to others	-.43
23p	Diverting/entertaining	-.51
13p	Demonstrating	-.54
24p	Socializing	-.58
2p	Serving/catering	-.67
31p	General public	-.88
30p	Customers	-.92
Dimension D-6: Teaching/instructing activities.		
32p	Students	.80
15p	Teaching/instructing	.56

Table 5 (continued)

	Job Dimension	Rotated Loading[a]
Dimension D-6: (continued)		
11p	Giving information to others	.48
13p	Demonstrating	.44
16p	Advising/counseling	.36
7p	Evaluating	.32
12p	Obtaining information from others	.32

[a] Rotated loadings less than .29 were omitted.

Dimensions of Work Goals

The analysis of the OAI Work Goals section produced 16 interpretable factors accounting for 88 percent of the total variance. These factors are presented in Table 6.

Dimension E-1: Objectives pertaining to installation, assembly, and construction. This dimension is primarily concerned with objectives related to the installation, assembly, and construction of devices, structures, and objects. Three items in this factor are subsumed under Connecting/Attaching Objectives in the OAI, and two other items (5g and 16g) refer specifically to installation and assembly objectives. This factor is relevant to mechanical work, as reflected by the four significant items from the OAI Mechanical Objectives group. Also included are items relating to Electrical Objectives and Objectives Accomplished Through Material/Object Arrangement or Modification.

Dimension E-2: Objectives pertaining to written communication. This factor includes all of the OAI items pertaining to written objectives, plus one item (77g) dealing with oral communication.

Dimension E-3: Planning and innovation. This dimension emphasizes planning and innovation in technology, science, business, and situations involving people (e.g., education).

Dimension E-4: Health and biological objectives. All of the OAI items dealing with biological/health objectives load significantly on this factor. These work elements cover objectives concerned with preventing, identifying, and treating health problems, along with other health and biological objectives.

Dimension E-5: Numerical/symbolic objectives. This factor contains all of the OAI items dealing with numerical objectives, plus three items pertaining to Business/Organizational Objectives. The two remaining items (55g and 85g) which have the lowest loadings on the factor, deal with encoded information and environmental charts, diagrams, and maps.

Dimension E-6: Spatial relations objectives. This dimension emphasizes work goals related to the spatial arrangement of objects or figures. Three items (33g, 34g, and 57g) deal with the arrangement of objects, while seven items (9g, 19g, 35g, 39g, 55g, 61g, and 84g) pertain to diagrams, drawing, and charts. Several content areas are represented in this factor, including: environment, astronomy, mechanics, art/decoration, electrical/electronic, and construction.

Dimension E-7: Business/sales objectives. Important to this dimension are items directly concerned with techniques related to sales, including merchandising, advertising, and public relation objectives. Also important are work elements associated with the accomplishment of business/organizational goals, such as employee relations, organizational plans and innovations, business communication, and contracts. Additional objectives concern attitude change

Table 6. Dimensions of Work Goals

	Job Dimension	Rotated Loading[a]
Dimension E-1:	Objectives pertaining to installation, assembly, and construction.	
24g	Installed or attached objects	.53
5g	Mechanical devices installed or assembled	.50
22g	Completed structures and other constructed objects	.49
23g	Assembled or fabricated objects	.49
39g	Drawings or diagrams of constructed, assembled, modified, fabricated, or arranged objects/materials	.41
9g	Mechanical drawings	.38
3g	Mechanical functioning maintained	.36
4g	Proper mechanical functioning restored	.36
16g	Electrical/electronic devices installed or assembled	.29
Dimension E-2:	Objectives pertaining to written communication.	
54g	Written communications pertaining to water, atmospheric or astronomical conditions or events	.94
49g	Written communications concerning terrain/earth features	.93
44g	Written communications concerning plant life	.91
38g	Written communications pertaining to material/object modification, assembly, or fabrication	.90
11g	Written communication of mechanical information	.89
112g	Written communications pertaining to animals	.89
37g	Written communications pertaining to construction, installation, or spatial arrangement	.85
21g	Written communication of electrical/electronic information	.82
109g	Written communications pertaining to people	.76
70g	Written biological/health communication completed	.73

Table 6 (continued)

	Job Dimension	Rotated Loading[a]
Dimension E-2: (continued)		
99g	Written business/organizational communication	.69
98g	Contracts and other legal documents drawn up	.67
73g	Non-standard or innovative written output	.65
62g	Art/decorative information communicated	.62
74g	Written material reviewed or edited for content	.57
75g	Written material edited or checked for composition and format	.50
72g	Routine written output	.49
77g	Oral information communicated	.46
Dimension E-3: Planning and innovation.		
48g	Innovations or plans concerning terrain/earth features	.87
10g	Mechanical plans or innovations	.85
53g	Innovations or plans concerning water, atmospheric, or astronomical conditions or events	.85
36g	Innovations or plans in assembly, fabrication, or material modification	.84
20g	Electrical/electronic innovations or plans	.80
35g	Innovations or plans in construction, installation, or spatial arrangement of objects	.78
97g	Organizational plans or innovations	.77
43g	Innovations or plans related to plant life	.75
71g	Biological/health innovations or plans	.67
108g	Innovations or plans pertaining to people	.64
80g	Solutions to advanced mathematical problems	.39
60g	Innovations in performing arts	.30

Table 6 (continued)

	Job Dimension	Rotated Loading[a]
Dimension E-4:	Health and biological objectives.	
63g	Causes or potential causes of health problems identified	.93
64g	Health problems relieved or eliminated	.92
65g	Potential health problems prevented or mitigated	.91
68g	Biological/health tests performed	.86
69g	Biological/health measurements taken	.86
66g	Medically related service tasks completed	.63
70g	Written biological/health communication completed	.62
67g	Biological/health inspections performed	.61
71g	Biological/health innovations or plans	.60
Dimension E-5:	Numerical/symbolic objectives.	
79g	Solutions to standard arithmetic problems	.94
82g	Numerical data displayed	.89
83g	Numerical information orally communicated	.86
94g	Balanced, verified, or updated business/organizational records	.86
96g	Business/organizational data gathered, compiled, or displayed	.85
81g	Records or transcribed numerical data	.82
80g	Solutions to advanced mathematical problems	.74
95g	Satisfactory index of organizational performance attained	.46
85g	Information encoded into written symbols or codes	.45
55g	Environmental charts, diagrams, or maps produced	.39

Table 6 (continued)

	Job Dimension	Rotated Loading[a]
Dimension E-6: Spatial relations objectives.		
33g	Spatially arranged objects	.79
52g	Astronomical events predicted, observed, or recorded	.68
84g	Completed diagrams, charts, and maps	.68
55g	Environmental charts, diagrams, or maps produced	.67
9g	Mechanical drawings	.65
39g	Drawings or diagrams of constructed, assembled, modified, fabricated, or arranged objects/ materials	.65
34g	Properly located or placed objects	.63
57g	Aesthetically arranged objects or things	.58
51g	Atmospheric conditions monitored or forecasted	.54
19g	Electrical/electronic schematics and/or diagrams	.50
61g	Completed art/decorative plans or designs	.47
56g	Environmental emergencies detected, prepared for, or dealt with	.39
35g	Innovations or plans in construction, installation, or spatial arrangement of objects	.29
Dimension E-7: Business/sales objectives.		
89g	Completed sales or business/organizational transactions	.84
93g	Public relations accomplishments	.76
90g	Merchandise shelved, packaged, stored, demonstrated, or otherwise handled	.64
91g	Advertising material produced, displayed, or disseminated	.64
92g	Employee relations accomplishments	.63
103g	Attitude, opinion, or belief change in others	.53
95g	Satisfactory index of organizational performance attained	.51

Table 6 (continued)

	Job Dimension	Rotated Loading[a]
Dimension E-7: (continued)		
97g	Organizational plans or innovations	.42
99g	Written business/organizational communication	.41
98g	Contracts and other legal documents drawn up	.34
106g	Financial or legal position of others improved or maintained	.32
107g	Enjoyment, satisfaction, or mood change of others	.31
77g	Oral information communicated	.30
Dimension E-8: Agricultural objectives.		
40g	Soil prepared and/or plants, shrubs, or trees planted	.94
42g	Plant products harvested or extracted	.93
41g	Plant life maintained	.92
45g	Raw geological materials extracted	.71
46g	Terrain or earth features modified	.71
47g	Satisfactory condition of earth/terrain features maintained	.71
56g	Environmental emergencies detected, prepared for, or dealt with	.54
43g	Innovations or plans related to plant life	.41
34g	Properly located or placed objects	.39
90g	Merchandise shelved, packaged, stored, demonstrated, or otherwise handled	.38
111g	Performance of animals improved, assessed, or controlled	.36
44g	Written communications concerning plant life	.30

Table 6 (continued)

	Job Dimension	Rotated Loading[a]
Dimension E-9:	Inspection/testing objectives.	
32g	Satisfactory condition or state of modified objects, materials, or substances, including formed, shaped, and treated materials and finished surfaces	.77
31g	Satisfactory condition of assembled or fabricated objects, excluding mechanical and electrical/electronic devices	.73
30g	Satisfactory condition of structures and other constructed objects	.71
50g	Maintenance of satisfactory water conditions and/or detection of unsatisfactory water conditions	.60
67g	Biological/health inspections performed	.51
1g	Substandard conditions of mechanical deviced detected	.48
6g	Satisfactory output from mechanical devices	.43
12g	Substandard conditions of electrical/electronic devices detected	.42
18g	Satisfactory output from electrical/electronic devices	.33
68g	Biological/health tests performed	.33
2g	Causes of mechanical malfunction located or identified	.32
Dimension E-10:	Clerical objectives.	
87g	Reproduced semantic/symbolic material	.91
88g	Semantic/symbolic material verified	.91
76g	Written material categorized	.90
78g	Verbal material transcribed	.83
75g	Written material edited or checked for composition and format	.68

Table 6 (continued)

Job Dimension		Rotated Loading[a]
Dimension E-10: (continued)		
85g	Information encoded into written symbols or codes	.64
72g	Routine written output	.56
74g	Written material reviewed or edited for content	.55
81g	Recorded or transcribed numerical data	.40
Dimension E-11: Electrical/electronic objectives.		
14g	Electrical/electronic functioning maintained	.81
13g	Causes of electrical/electronic malfunction located or identified	.78
15g	Electrical/electronic functioning restored	.78
18g	Satisfactory output from electrical/electronic devices	.77
17g	Electrical/electronic devices regulated, adjusted, or controlled	.76
16g	Electrical/electronic devices installed or assembled	.72
12g	Substandard conditions of electrical/electronic devices detected	.71
19g	Electrical/electronic schematics and/or diagrams	.66
21g	Written communication of electrical/electronic information	.45
20g	Electrical/electronic innovations or plans	.40
Dimension E-12: Objectives related to the behavior of others.		
77g	Oral information communicated	-.32
92g	Employee relations accomplishments	-.39
106g	Financial or legal position of others improved or maintained	-.48
107g	Enjoyment, satisfaction, or mood change of others	-.49

Table 6 (continued)

	Job Dimension	Rotated Loading[a]
Dimension E-12: (continued)		
108g	Innovations or plans pertaining to people	-.50
103g	Attitude, opinion, or belief change in others	-.53
111g	Performance of animals improved, assessed, or controlled	-.61
104g	Others' compliance with directions, rules, or laws insured or monitored	-.78
105g	Improved adjustment or adaption of others	-.80
101g	Physical competence of others improved or assessed	-.89
102g	Others' knowledge improved or assessed	-.89
Dimension E-13: Art/decorative objectives.		
59g	Successfully completed performance	.91
60g	Innovations in performing arts	.82
86g	Information transmitted by non-written codes and signals	.64
62g	Art/decorative information communicated	.54
61g	Completed art/decorative plans or designs	.50
58g	Original art objects	.35
57g	Aesthetically arranged objects or things	.34
Dimension E-14: Mechanical objectives.		
5g	Mechanical devices installed or assembled	-.51
8g	People, objects, or materials transported	-.58
4g	Proper mechanical functioning restored	-.65
6g	Satisfactory output from mechanical devices	-.65
1g	Substandard conditions of mechanical devices detected	-.66
3g	Mechanical functioning maintained	-.68

Table 6 (continued)

	Job Dimension	Rotated Loading[a]
Dimension E-14: (continued)		
7g	Properly regulated or controlled mechanical devices	-.71
2g	Causes of mechanical malfunction located or identified	-.73
Dimension E-15: Objectives related to the aesthetic appearance of people and animals.		
110g	Improved state of grooming or appearance of animals	.72
100g	Improved state of grooming or appearance of people	.71
58g	Original art objects	.50
57g	Aesthetically arranged objects or things	.39
61g	Completed art/decorative plans or designs	.36
91g	Advertising material produced, displayed, or disseminated	.33
111g	Performance of animals improved, assessed, or controlled	.30
86g	Information transmitted by non-written codes and signals	-.29
Dimension E-16: Material modification/arrangement objectives.		
45g	Raw geological materials extracted	-.29
24g	Installed or attached objects	-.31
31g	Satisfactory condition of assembled or fabricated objects, excluding mechanical and electrical/electronic devices	-.32
30g	Satisfactory condition of structures and other constructed objects	-.33
22g	Completed structures and other constructed objects	-.36

Table 6 (continued)

	Job Dimension	Rotated Loading[a]
Dimension E-16: (continued)		
32g	Satisfactory condition or state of modified objects, materials, or substances, including formed, shaped, and treated materials and finished surfaces	-.38
23g	Assembled or fabricated objects	-.39
25g	Shaped objects	-.73
29g	Treated materials or substances	-.81
27g	Finished or prepared surfaces	-.82
26g	Formed objects	-.86
28g	Materials/substances modified by miscellaneous mechanical actions, excluding material removal and forming	-.91

[a] Rotated loadings less than .29 were omitted.

in others, improved financial or legal position of others, and the enjoyment or satisfaction of others--all of which are consistent with business and sales goals.

Dimension E-8: Agricultural objectives. This factor emphasizes work elements concerned with agricultural and terrain/earth objectives. In addition to items dealing with plant life, soil preparation and maintenance, and animals, this factor incorporates one item pertaining to merchandising (90g).

Dimension E-9: Inspection/testing objectives. This dimension is marked by items concerned with the outcomes of inspecting, testing, and monitoring. The work objectives in this factor deal with the condition or functioning of objects, structures, devices, certain aspects of the environment, and organisms or biological material. Some of the elements suggest the involvement of maintenance (or correction), as well as detection, objectives.

Dimension E-10: Clerical objectives. Work elements pertaining to secretarial and other related clerical tasks define this factor. The objectives included involve verifying, categorizing, reproducing, transcribing, editing, encoding, and recording.

Dimension E-11: Electrical/electronic objectives. This factor emphasizes objectives related to electrical/electronic maintenance, troubleshooting, repair, and installation. All of the items in the OAI Electrical Objectives group are contained in the factor. Electrical objectives requiring direct contact with electrical components are stressed over indirect objectives (e.g., the production of diagrams, drawings, written communications, or plans), although three items dealing with the latter types of objectives do load on the factor.

Dimension E-12: Objectives related to the behavior of others. This dimension contains a variety of work elements involving interaction with people (and in one instance animals). The objectives defined in these work elements deal primarily with improving, evaluating, or controlling the behavior of others. The heaviest loading items concern others' knowledge, physical competence, adjustment, and compliance.

Dimension E-13: Art/decorative objectives. This dimension contains work elements pertaining to art and decorative objectives. The two highest loading items concern the performing arts; lesser loading items deal with communication, plans and designs, art objects, and aesthetic arrangement. The substantial loading on Item 86g is consistent with the emphasis on the performing arts (e.g., music and stage). With the exception of Item 86g, all of the elements defining this factor belong to the OAI group titled Art/Decorative Objectives.

Dimension E-14: Mechanical objectives. This is a broad dimension involving objectives related to machine operation, maintenance, repair, and installation. The inclusion of Items 7g and 8g suggests the operation of transportation equipment. Only objectives requiring direct contact with mechanical devices are included in this dimension; indirect mechanical objectives, such as producing drawings, written communications, and innovations related to mechanical devices, do not load on this factor.

Dimension E-15: Objectives related to the aesthetic appearance of people and animals. This dimension seems to be primarily oriented toward the improved appearance of people or animals. Besides the items dealing directly with people and animals, several items (producing original art objects, art/decorative plans or designs, and advertising material) suggest the representation of people and animals in an aesthetically pleasing manner. The objective of aesthetically arranging objects (57g) might involve providing an appealing background or environment for people or animals, or working directly on the aesthetic arrangement of clothes, accessories, etc.

Dimension E-16: Material modification/arrangement objectives. The highest loading items on this factor pertain to the modification of materials through shaping, forming, treating, and abrading/coating. Lesser loading items define objectives involving connecting/attaching (assembly, construction, and installation), and ensuring the satisfactory condition of modified and connected/attached materials and objects.

Dimensions of Work Context

The principal components analysis of the Work Context section yielded 12 interpretable factors accounting for 80 percent of the total variance. The items with significant loadings on these factors are listed in Table 7.

Dimension F-1: White collar working conditions. The items loading on this dimension refer to aspects of the work context which are typically associated with white collar work. Business attire, a consistent daytime schedule, working individually in a specified area (*e.g.*, a desk), and the possibility of social interaction all suggest an office environment. Item 23c, casual apparel, might apply to the less formal attire worn in some offices.

Dimension F-2: Unpleasant physical working conditions. The second dimension to emerge from this section emphasizes working conditions which cause physical discomfort. Included are such conditions as undesirable temperature (high, low, or fluctuating), exposure to weather, uncomfortable body positions, humidity, wetness, and vibration.

Dimension F-3: Situations requiring social interaction. This factor is defined by items concerned with work situations requiring

Table 7. Dimensions of Work Context

	Job Dimension	Rotated Loading[a]
Dimension F-1:	White collar working conditions.	
25c	Business attire	.82
23c	Casual apparel	.50
38c	Day hours	.47
52c	Working individually in the presence of co-workers or others where social interaction is possible	.40
35c	Consistent schedule	.37
43c	Confinement to a specified work space	.30
Dimension F-2:	Unpleasant physical working conditions.	
11c	Low temperature	1.00
10c	High temperature	.92
12c	Sudden temperature changes	.88
7c	Uncomfortable body positions	.78
9c	Unpleasant weather conditions	.69
6c	Vibration	.68
3c	Humid	.55
2c	Wet	.43
Dimension F-3:	Situations requiring social interaction.	
60c	Social obligations	.89
59c	Civic obligations	.84
58c	Unpleasant social relationships	.83
57c	Interpersonal conflict	.77
53c	Working jointly with others as part of a team where social interaction and co-operation are necessary	.72

Table 7 (continued)

Job Dimension		Rotated Loading[a]
Dimension F-3: (continued)		
54c	Working individually in a one-to-one relationship with a customer, client, student, etc., where social interaction is restricted primarily to that person	.60
41c	Distractions or interruptions	.39
55c	Conflicting job demands	.39
56c	Moral value conflict	.38
52c	Working individually in the presence of co-workers or others where social interaction is possible	.31
Dimension F-4: Novel work situations.		
31c	Task diversity	.90
42c	Novel situations	.89
41c	Distractions or interruptions	.47
51c	Working alone with little or no opportunity for social interaction	.43
34c	Irregular work	.40
37c	Variable hours	.36
44c	Rush situations	.34
46c	Updating knowledges, techniques, and skills	.30
Dimension F-5: Hazardous working conditions.		
48c	Safety consequences of errors	-.30
4c	Dirty environment	-.34
18c	Toxic conditions	-.47
17c	Electrical hazards	-.53
5c	Improper illumination	-.58
13c	Mechanical hazards	-.61

Table 7 (continued)

	Job Dimension	Rotated Loading[a]
Dimension F-5: (continued)		
16c	Exposure to burns	-.69
15c	High places	-.74
20c	Overall hazard of the job	-.78
19c	Other hazards	-.87
14c	Moving or falling objects	-.88
Dimension F-6: Seasonal outdoor work.		
33c	Seasonal work	.85
22c	Work clothes	.79
4c	Dirty environment	.64
1c	Work location	.59
2c	Wet	.47
3c	Humid	.35
34c	Irregular work	.35
23c	Casual apparel	.33
Dimension F-7: Responsibility.		
47c	Financial or material consequences of errors	.85
49c	Intangible consequences of errors	.80
50c	Organizational responsibility	.79
48c	Safety consequences of errors	.69
46c	Updating knowledges, techniques, and skills	.42
56c	Moral value conflict	.30
Dimension F-8: Uniformed personal service situations.		
48c	Safety consequences of errors	-.29
53c	Working jointly with others as part of a team where social interaction and co-operation are necessary	-.32

Table 7 (continued)

Job Dimension		Rotated Loading[a]
Dimension F-8: (continued)		
54c	Working individually in a one-to-one relationship with a customer, client, student, etc., where social interaction is restricted primarily to that person	-.36
36c	Changing shift work	-.57
39c	Night hours	-.71
40c	Variable day-night hours	-.75
24c	Uniform	-.76
Dimension F-9: Hazardous mechanical environment.		
8c	Noise intensity	.67
51c	Working alone with little or no opportunity for social interaction	.48
6c	Vibration	.46
21c	Safety apparel	.46
13c	Mechanical hazards	.31
Dimension F-10: High places.		
1c	Work location	.60
15c	High places	.39
7c	Uncomfortable body positions	.34
2c	Wet	-.30
3c	Humid	-.36
Dimension F-11: Inconsistent work demands.		
45c	Time away from home	.72
55c	Conflicting job demands	.56
37c	Variable hours	.52

Table 7 (continued)

	Job Dimension	Rotated Loading[a]
Dimension F-11: (continued)		
34c	Irregular work	.45
56c	Moral value conflict	.45
40c	Variable day-night hours	.40
39c	Night hours	.36
57c	Interpersonal conflict	.30
Dimension F-12: Work structure.		
27c	Timing and sequence	.83
28c	Speed	.81
26c	Work procedures	.77
30c	Goals	.77
29c	Performance standards	.69
43c	Confinement to a specified work space	.58
32c	Steady work	.46
21c	Safety apparel	.45
35c	Consistent schedule	.44
36c	Changing shift work	.43
22c	Work clothes	.41
44c	Rush situations	.38
23c	Casual apparel	.35
41c	Distractions or interruptions	.34
38c	Day hours	.31

[a] Rotated loadings less than .29 were omitted.

social interaction. Substantial loading items deal with social and civic obligations, working as a member of a team, interpersonal conflict, unpleasant social relationships, and working in one-to-one relationships with others. The sizable loadings of social and civic obligations suggest that this factor might characterize the social requirements of managerial positions.

Dimension F-4: Novel work situations. This factor specifies situations in which the worker performs diverse and novel tasks, often under a demanding and irregular work schedule. The significant loadings of two apparently contradictory items--distractions and interruptions (41c) versus working alone with little opportunity for social interaction (51c)--suggest the possibility of two different types of work situations. Moreover, an element of creativity is implied by the high factor scores received by ARI attributes pertaining to literary interest, artistic interest, and the need for creativity (ARI Items 74, 81, and 94).

Dimension F-5: Hazardous working conditions. This dimension contains work elements pertaining to situations in which the incumbent is exposed to hazards. All of the OAI elements dealing with hazards are represented, including moving or falling objects, high places, exposure to burns, mechanical and electrical hazards, and toxic conditions.

Dimension F-6: Seasonal outdoor work. The work elements loading substantially on this dimension include: seasonal and irregular work; outdoor environment; work clothes and casual apparel; and dirty, wet, and humid work conditions. These conditions would be characteristic of farm and construction work.

Dimension F-7: Responsibility. All of the OAI items dealing with the consequences of errors contribute to this factor, including financial, intangible, and safety consequences, as well as organizational responsibility. The significant loading on the updating of knowledge and skill (46c) is consistent with this interpretation.

Dimension F-8: Uniformed personal service situations. This factor seems oriented toward situations in which uniformed personal service or care is provided. The elements with substantial loadings involve: wearing a uniform, working irregular hours, working with customers and clients, and working jointly with others. Such conditions would apply to jobs ranging from bellboy to nurse. Consistent with the above interpretation, the ARI attributes with high factor scores on this dimension (e.g., Personal service, #65; Nursing and related technical services, #71; Skilled personal service, #72) pertain to both skilled and unskilled service activities.

Dimension F-9: Hazardous mechanical environment. The items comprising this factor pertain to noise, vibration, mechanical hazards, and working alone. This combination of elements suggests a job situation in which the incumbent works on or near dangerous, powerful mechanical equipment.

Dimension F-10: High places. The nature of this factor is somewhat unclear. However, the positive loadings on outdoor work, high places, and uncomfortable body positions suggest elevated work situations such as those encountered by power linemen and structural steel workers. The negative loadings on wet and humid conditions are consistent with this interpretation, since elevated work locations are usually dry and work is usually not conducted in such locations under wet conditions.

Dimension F-11: Inconsistent work demands. The combination of items comprising this factor define a type of work situation involving irregular hours, time away from home, and conflicting demands. This kind of job context is similar to that encountered by doctors, salesmen, artists, and entertainers.

Dimension F-12: Work structure. The items with the highest loadings on this factor specify various constraints on the worker's activities, including timing and sequence, pace, procedures, goals, performance standards, and physical location. The remaining items deal with various elements that one might expect to find in a highly structured work situation.

Estimates of Factorial Stability

As previously noted, comparisons were made between factors derived independently from two samples of attribute-rating data (*i.e.*, halves of the original data set). These comparisons were made for each of the six sectional factor analyses. The resulting matrices of Tucker and Pearson coefficients are shown in Appendix F. Each matrix of coefficients was examined to identify for each factor in one sample the closest correspondent in the other sample. This comparison was performed in both directions (*i.e.*, from Sample 1 to Sample 2, and vice versa), since in a few instances, a factor's closest correspondent in the other sample (Sample 2) was, in turn, more highly related to a third factor in the first sample. However, in the few cases where such nonreciprocities occurred, the coefficients of relationship were low, indicating that the factors in question had no direct correspondents in opposite samples. Tables 8 and 9 contain frequency distributions of the highest Tucker and Pearson coefficients for the factors in Sample 1 when compared with the factors in Sample 2. These distributions were compiled from the highest values in the columns of the matrices in Appendix F. Thus, the total number of observations in each distribution is 77, or the number of factors obtained from the six sectional analyses.

In order to determine whether Pearson correlations (based on factor scores) yielded results similar to the Tucker coefficients (based on factor loadings), the entries in corresponding matrices of coefficients were correlated; that is, for each of the six sectional analyses, the entire set of entries in the matrix of Tucker coefficients was correlated with the set of entries in the corresponding

Table 8. Frequency Distribution of the Coefficients of Congruence for 77 Factors Derived from Six Sections of the OAI

Coefficients of Congruence	Frequency	Proportion	Cumulative Proportion
.90 - .99	33	.428	1.000
.80 - .89	14	.182	.572
.70 - .79	12	.156	.390
.60 - .69	7	.091	.234
.50 - .59	6	.078	.143
.40 - .49	3	.039	.065
.30 - .39	1	.013	.026
.20 - .29	1	.013	.013
.10 - .19	0	.000	.000
.00 - .09	0	.000	.000
Total	77		

Table 9. Frequency Distribution of the Correlation Coefficients for 77 Factors Derived from Six Sections of the OAI

Correlation Coefficients	Frequency	Proportion	Cumulative Proportion
.90 - .99	16	.208	1.000
.80 - .89	21	.273	.793
.70 - .79	17	.221	.520
.60 - .69	9	.117	.299
.50 - .59	8	.104	.182
.40 - .49	4	.052	.078
.30 - .39	1	.013	.026
.20 - .29	0	.000	.013
.10 - .19	1	.013	.013
.00 - .09	0	.000	.000
Total	77		

matrix of Pearson coefficients. The product-moment correlations between the six pairs of matrices were as follows: (1) .94, (2) .93, (3) .98, (4) .92, (5) .95, and (6) .87. Thus, it would appear that the two methods of estimating factorial stability yield comparable results.

Higher-Order Factors

The 21 factors obtained from the higher-order analysis are shown in Table 10. This table contains the substantial rotated loadings for each of the higher-order factors on the 77 original (first-order) factors. The higher-order factors will not be described here but can be interpreted by referring to the descriptions of the first-order factors comprising them. The correlation matrix for the higher-order factors is presented in Appendix G.

Table 10. Higher-Order Work Dimensions

Work Dimension		Rotated Loadings
Dimension H-1: Machine operation, maintenance, and repair.		
First-Order Factors		
C-7	Abstract versus machine-aided representational activities	.31[a]
C-5	Communication by visual and auditory code	-.29
B-14	Precise control operations versus general body activities	-.37[a]
F-9	Hazardous mechanical environment	-.40
F-5	Hazardous working conditions	-.44[b]
B-12	Stationary equipment operation	-.57
A-1	Information concerning mechanical devices/ processes	-.71
B-3	Mechanized equipment operation	-.71
E-14	Mechanical objectives	-.82[b]
Dimension H-2: Behavior modification and control.		
First-Order Factors		
E-12	Objectives related to the behavior of others	.90[b]
A-14	Information pertaining to the performance of humans and animals	.84
D-2	Supervising	.72
D-6	Teaching/instructing activities	.70
A-10	Information pertaining to human events and characteristics	.44[b]
F-3	Situations requiring social interaction	.43
C-6	Interpersonal communication	.42

Table 10 (continued)

Work Dimension		Rotated Loadings
Dimension H-3: Mathematical symbolic activities.		
First-Order Factors		
A-5	Numerical/symbolic information	.96
E-5	Numerical/symbolic objectives	.94
C-2	Mathematical/computational activities	.93
Dimension H-4: Health related activities.		
First-Order Factors		
E-4	Health and biological objectives	.94
B-4	Medical/veterinary activities	.93
A-3	Health information	.92
D-4	Medically related interpersonal activities	.77
F-3	Uniformed personal service situations	.44[b]
F-1	White collar working conditions	-.29
Dimension H-5: Figural arrangements and relationships.		
First-Order Factors		
E-6	Spatial relations objectives	.85
A-9	Spatial information	.73
C-4	Pictorial representation	.55
A-4	Information pertaining to aesthetic appearance and arrangement	.53
A-10	Information pertaining to human events and characteristics	.36[b]
B-18	Handicraft activities	.36

Table 10 (continued)

	Work Dimension	Rotated Loadings
Dimension H-5: (continued)		
First-Order Factors		
F-5	Hazardous working conditions	.32[b]
B-8	Eye-hand versus eye-foot coordination	-.40[a]
Dimension H-6: Personal service activities.		
First-Order Factors		
A-18	Personal service information	.83[b]
E-15	Objectives related to the aesthetic appearance of people and animals	.78
F-1	White collar working conditions	.46
B-9	Physical activities associated with personal service and treatment	.40
B-18	Handicraft activities	.38
B-15	Food processing	.37
F-8	Uniformed personal service situations	.34[b]
C-4	Pictorial representation	.29
Dimension H-7: Agricultural activities.		
First-Order Factors		
B-10	Agriculturally related activities	.92[b]
A-8	Environmental information	.89
F-6	Seasonal outdoor work	.78
E-8	Agricultural objectives	.77

Table 10 (continued)

Work Dimension		Rotated Loadings
Dimension H-8: Clerical activities.		
First-Order Factors		
B-8	Eye-hand versus eye-foot coordination	.35[a]
F-1	White collar working conditions	-.29
F-12	Work structure	-.36
A-12	Clerical information	-.90
C-3	Clerical activities	-.92
E-10	Clerical objectives	-.97
Dimension H-9: Verbal activities.		
First-Order Factors		
A-2	Technical written information	.92
E-2	Objectives pertaining to written communication	.90
C-1	Verbal communication	.75
D-1	Conflict resolution	.43
D-6	Teaching/instructing activities	.39
Dimension H-10: Art/decorative activities.		
First-Order Factors		
A-15	Art/decorative information	.94
E-13	Art/decorative objectives	.88
C-5	Communication by visual and auditory code	.44
F-9	Hazardous mechanical environment	.37

Table 10 (continued)

Work Dimension		Rotated Loadings
Dimension H-11: Material processing and modification.		
First-Order Factors		
E-9	Inspection/testing objectives	-.30
B-6	Construction work	-.33
B-15	Food processing	-.55
E-16	Material modification/arrangement objectives	-.72[b]
A-6	Materials information	-.82
B-7	Material processing	-.90[b]
Dimension H-12: Business/sales activities.		
First-Order Factors		
E-7	Business/sales objectives	.93
A-7	Business/sales information	.91
D-5	Sales/customer-service activities	.72[b]
F-3	Situations requiring social interactions	.50
F-11	Inconsistent work demands	.43
D-1	Conflict resolution	.35
A-10	Information pertaining to human events and characteristics	.31[b]
Dimension H-13: Work activities requiring balance and body coordination.		
First-Order Factor		
B-16	General body coordination	.75
F-10	High places	.57[a]
B-5	Strenuous work activities	.38
E-8	Agricultural objectives	.32

Table 10 (continued)

Work Dimension		**Rotated Loadings**
Dimension H-14: Medically related responsibility.		
First-Order Factors		
D-4	Medically related interpersonal activities	.68
F-7	Responsibility	.63
F-11	Inconsistent work demands	.51
F-4	Novel work situations	.43
F-12	Work structure	.40
B-9	Physical activities associated with personal service and treatment	.36
F-8	Uniformed personal service situations	.32[b]
Dimension H-15: Construction and assembly activities.		
First-Order Factors		
A-17	Structural information	.88[b]
B-6	Construction work	.73
E-1	Objectives pertaining to installation, assembly, and construction	.71
B-13	Joining/connecting activities	.50
Dimension H-16: Planning and innovation.		
First-Order Factors		
D-2	Supervising	-.29
F-7	Responsibility	-.32
C-7	Abstract versus machine-aided representational activities	-.46[a]
F-4	Novel work situations	-.46
E-3	Planning and innovation	-.76

Table 10 (continued)

Work Dimension		Rotated Loadings
Dimension H-17:	Direct interpersonal communication.	
First-Order Factors		
A-16	Oral/auditory information	.88
C-6	Interpersonal communication	.32
D-5	Sales/customer-service activities	.29
B-18	Handicraft activities	-.31
F-11	Inconsistent work demands	-.36
C-4	Pictorial representation	-.38
Dimension H-18:	Electrical/electronic maintenance and repair.	
First-Order Factors		
B-13	Joining/connecting activities	-.46
B-11	Mechanical and electrical maintenance and repair	-.65
E-11	Electrical/electronic objectives	-.94
A-11	Electrical/electronic information	-.96[b]
Dimension H-19:	Inspecting, measuring, and testing.	
First-Order Factors		
A-13	Information from measuring and testing devices	.90
B-2	Use of measuring devices	.80
E-9	Inspection/testing objectives	.57
A-6	Materials information	.29

Table 10 (continued)

Work Dimension		Rotated Loadings
Dimension H-20: General tool usage.		
First-Order Factors		
B-1	Tool usage	.60
E-1	Objective pertaining to installation, assembly, and construction	.47
B-17	Unskilled machine-related activities	.45[b]
E-16	Material modification/arrangement objectives	.37[b]
B-5	Strenuous work activities	.36
E-9	Inspection/testing objectives	-.31
Dimension H-21: General physical labor.		
First-Order Factors		
F-2	Unpleasant physical working conditions	.65
B-5	Strenuous work activities	.39
B-8	Eye-hand versus eye-foot coordination	.36
B-14	Precise control operations versus general body activities	-.46

[a] This is a bipolar first-order factor. The sign of the loading identifies the pole of the first-order factor that is positively related to the higher-order factor.

[b] The sign of this loading has been reversed. Since all significant loadings on the first-order factor were negative, the sign of its loading on the higher-order factor was reversed to allow for correct interpretation.

DISCUSSION

The first phase of this study involved the development of the Attribute Requirement Inventory (ARI) and the subsequent derivation of attribute-requirement estimates for the work elements in the Occupation Analysis Inventory (OAI). In the development of the ARI, human attributes were selected which (a) seemed relevant to work analysis, (b) were defined concretely enough to be potentially ratable, and (c) were measured by existing tests. For each selected attribute, an item was constructed which included a verbal definition plus cited examples of job activities requiring the attribute.

In the derivation of the attribute-requirement estimates for OAI work elements, steps were taken to ensure favorable rating conditions. The first step involved efforts to construct comprehensive descriptions of the selected attributes, including concrete examples of work activities. It was hoped that such descriptions would give the raters a clear understanding of each attribute, thereby reducing the possibility of different interpretations by individual raters. Secondly, the ARI rating instructions clearly pointed out to the rater the possibility of reversing the rating procedure--i.e., rating the attribute on the OAI work element, rather than rating the contribution of the attribute to that work element. This particular problem was noted in a similar study reported by Mecham and McCormick (1969a). Finally, a distinction was made in the rating instructions between two categories of attributes: (1) abilities, including General Vocational Capabilities, Cognitive Abilities, Psychomotor Abilities, and Sensory Capacities; and (2) affective attributes, including Interests and Needs. The rater was instructed to rate the abilities in terms of the "amount" or "level" of the attribute in question required of the worker in order to deal effectively with the OAI work element. On the other hand, the rater was asked to rate the affective attributes on the extent to which the attribute in question was "compatible" (or would lead to satisfaction) with the OAI work element. This distinction seemed appropriate, since the effect of abilities upon job performance is probably considerably more direct than that of interests and needs.

The reliabilities of the attribute weights for OAI items are substantial. Only six of the 103 unadjusted coefficients for mean attribute ratings fell below .80, and the median value fell within the .90 to .94 range (see Table 1). Further, only one of the 103 sets of mean attribute ratings was too unreliable for use. The low reliability of the mean ratings on Moral Values (Item 96 of the ARI) seems attributable to an inappropriate wording of its item description. The remaining five attribute reliabilities that were below .80 could probably be raised above that value by increasing the number of raters contributing to the mean attribute estimates and, in some instances, by revising the ARI items. The distribution of the reliability coefficients in this study is comparable to that obtained by Mecham and McCormick (1969a) from attribute ratings of the job elements in the Position Analysis Questionnaire.

Tables 11 and 12 summarize the factors obtained in this study. These 77 first-order and 21 higher-order factors seem quite meaningful; all 98 of these factors were interpreted. Moreover, the factor comparisons across split analyses provide some evidence for the stability of the factor structures obtained in the six sectional analyses. Of the 77 coefficients of congruence represented in Table 8, 47 are above .79 and 57 (or 77 percent) exceed .70; among the 77 Pearson coefficients (Table 9), 37 exceed .79, 54 exceed .70, and 63 (82 percent) are above .59.[2] The two sets of coefficients follow quite similar patterns, as evidenced by the high correlations between the entries in corresponding matrices of Tucker and Pearson coefficients (see p. 79). It would appear, then, that the two different procedures for determining relationships between factors yield similar results, even though one employs factor loadings and the other factor scores.

Unfortunately, there is no test of significance for the coefficient of congruence, and its interpretation is somewhat ambiguous (Pinneau and Newhouse, 1964). Tucker (1951) has described a congruence coefficient of .9398 as "moderately high," and coefficients of .9997 and above as "high." As noted by Struening and Cohen (1963), however, ". . . the variables in Tucker's study were tests or item composites rather than single . . . items with known high errors of measurement." Accordingly, in comparing factors derived from test items, these investigators accepted the considerably lower value of .787 as an indication of ". . . a moderate degree of congruence"; and Thomson (1963), in a comparison of factors based on life-history items, designated a value of .60 as a criterion for factorial congruence, provided the two factors being compared had three or more loadings of .15 or greater in common (a requirement also proposed by Tucker).

The reliabilities of the variables employed in the present study (the OAI items) would undoubtedly be lower than the reliabilities of test scores but probably somewhat higher than those of individual test items. However, no direct estimates were made of the reliabilities of the OAI items. Instead, reliabilities were computed for the mean attribute ratings of the OAI items, per attribute. Although the mean attribute estimates derived from the total sample had substantial reliabilities (see Table 1), the factors obtained in the split analyses were derived from mean ratings based on only half of the total data. Therefore, the reliabilities of both the rating means and the derived factors, if computed, would be considerably lower in the split analyses than in the analyses employing the total set of data. To the extent that dividing the total sample reduced item reliabilities, the Tucker and Pearson coefficients obtained in the factor comparisons between the split samples could be expected to underestimate the invariance of the factors derived

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[2] A Pearson product-moment correlation of .60 is significant beyond the .001 level ($t = 9.38$, df = 100).

Table 11 Summary of the 77 Work Dimensions Obtained from the Six Sectional Factor Analyses

OAI Section and Dimension	Title of Dimension
Information Received	
A-1	Information concerning mechanical devices/processes
A-2	Technical written information
A-3	Health information
A-4	Information pertaining to aesthetic appearance and arrangement
A-5	Numerical/symbolic information
A-6	Materials information
A-7	Business/sales information
A-8	Environmental information
A-9	Spatial information
A-10	Information pertaining to human events and characteristics
A-11	Electrical/electronic information
A-12	Clerical information
A-13	Information from measuring and testing devices
A-14	Information pertaining to the performance of humans and animals
A-15	Art/decorative information
A-16	Oral/auditory information
A-17	Structural information
A-18	Personal service information
Physical Work Behavior	
B-1	Tool usage
B-2	Use of measuring devices
B-3	Mechanized equipment operation
B-4	Medical/veterinary activities
B-5	Strenuous work activities
B-6	Construction work
B-7	Material processing
B-8	Eye-hand versus eye-foot coordination
B-9	Physical activities associated with personal service and treatment
B-10	Agriculturally related activities
B-11	Mechanical and electrical maintenance and repair
B-12	Stationary equipment operation
B-13	Joining/connecting activities
B-14	Precise control operations versus general body activities

Table 11 (continued)

OAI Section and Dimension	Title of Dimension
Physical Work Behavior (continued)	
B-15	Food processing
B-16	General body coordination
B-17	Unskilled machine-related activities
B-18	Handicraft activities
Representational Work Behavior	
C-1	Verbal communication
C-2	Mathematical/computational activities
C-3	Clerical activities
C-4	Pictorial representation
C-5	Communication by visual and auditory code
C-6	Interpersonal communication
C-7	Abstract versus machine-aided representational activities
Interpersonal Work Behavior	
D-1	Conflict resolution
D-2	Supervising
D-3	Multiple-status interpersonal interaction
D-4	Medically related interpersonal activities
D-5	Sales/customer-service activities
D-6	Teaching/instructing activities
Work Goals	
E-1	Objectives pertaining to installation, assembly, and construction
E-2	Objectives pertaining to written communication
E-3	Planning and innovation
E-4	Health and biological objectives
E-5	Numerical/symbolic objectives
E-6	Spatial relations objectives
E-7	Business/sales objectives
E-8	Agricultural objectives
E-9	Inspection/testing objectives
E-10	Clerical objectives
E-11	Electrical/electronic objectives

Table 11 (continued)

OAI Section and Dimension	Title of Dimension
Work Goals (continued)	
E-12	Objectives related to the behavior of others
E-13	Art/decorative objectives
E-14	Mechanical objectives
E-15	Objectives related to the aesthetic appearance of people and animals
E-16	Material modification/arrangement objectives
Work Context	
F-1	White collar working conditions
F-2	Unpleasant physical working conditions
F-3	Situations requiring social interaction
F-4	Novel work situtations
F-5	Hazardous working conditions
F-6	Seasonal outdoor work
F-7	Responsibility
F-8	Uniformed personal service situations
F-9	Hazardous mechanical environment
F-10	High places
F-11	Inconsistent work demands
F-12	Work structure

Table 12. Summary of the 21 Higher-Order Work Dimensions

Dimension	Title of Work Dimension
H-1	Machine operation, maintenance, and repair
H-2	Behavior modification and control
H-3	Mathematical/symbolic activities
H-4	Health related activities
H-5	Figural arrangements and relationships
H-6	Personal service activities
H-7	Agricultural activities
H-8	Clerical activities
H-9	Verbal activities
H-10	Art/decorative activities
H-11	Material processing and modification
H-12	Business/sales activities
H-13	Work activities requiring balance and body coordination
H-14	Medically related responsibility
H-15	Construction and assembly activities
H-16	Planning and innovation
H-17	Direct interpersonal communication
H-18	Electrical/electronic maintenance and repair
H-19	Inspecting, measuring, and testing
H-20	General tool usage
H-21	General physical labor

from the total sample of ratings; *i.e.*, the coefficients obtained in this study are considerably lower than would be the case if the factors derived from the total set of data (and presented in Tables 2 through 7) were compared with factors derived from a second, comparable sample of the same size.

In addition to the aforementioned attenuation due to decreased reliability the Pearson coefficients were further reduced by the use of independently derived factor coefficients to compute factor scores in each of the two samples. This procedure is contrary to the recommendation of Pinneau and Newhouse (1964) that the same set of factor loadings be used in deriving factor scores for both samples, in order to eliminate from the between-sample comparisons the error associated with the factor loadings (hence with the factor coefficients).

On the other hand, it must also be noted that both the Tucker and Pearson coefficients represented in Tables 8 and 9 were obtained by selecting the highest coefficient in each column of the matrices in Appendix F, rather than on the basis of *a priori* matching of factors prior to the computation of the entries in these matrices. The use of this *a posteriori* procedure, as opposed to the *a priori* approach, increases the likelihood of selecting coefficients that are merely chance occurrences. However, the time required to interpret and match the factors obtained from the two separate samples would have been prohibitive, since only the factors based on the total set of data were to be retained for future use.

Finally, a distinction should be made between the factors obtained in this study, in which work elements were rated in terms of their human attribute requirements, and factors derived from the ratings of jobs on work elements. Since the factors in the present study are comprised of work elements (activities and conditions) which tend to have similar attribute-requirement profiles, these factors do not necessarily represent classes of work activities and conditions as they actually occur in the world of work. Instead, the factors based on the attribute profiles of work elements represent classes of activities and conditions which are relatively homogeneous in terms of their estimated human attribute requirements. An alternative factor-analytic data base, described in two subsequent reports (Riccobono and Cunningham, 1971a, 1971b), consists of the ratings of a large and representative sample of jobs on the OAI work elements. The OAI factors derived from the job-rating data represent classes of work elements which tend to coexist in the world of work. Although the factors based on job ratings may better represent the existing work structure than factors based on attribute ratings, their constituent work elements are less likely to be homogeneous in terms of human attribute requirements. In discussing the relative potential of these two kinds of work dimensions, Jeanneret and McCormick (1969) noted:

> . . . there is little substantive evidence available that can be brought to bear on the question as to which set of dimensions is the more useful. In fact, the answer to this question is highly dependent upon the particular purpose for which the dimensions might be used, and should be the subject of further empirical investigation [p. 98].

It might be speculated, however, that the OAI dimensions based on attribute ratings would prove the more useful in estimating the human attribute requirements of jobs and occupations, while the dimensions based on job ratings would be more appropriately used in describing and grouping jobs in terms of component work activities and conditions.

Subsequent reports in the Ergometric Research and Development Series will describe attempts to validate occupational clusters and attribute-requirement estimates based on the OAI work dimensions (Bates and Cunningham, 1972; Tuttle and Cunningham, 1972).

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APPENDICES

Appendix A

Tests Corresponding to ARI Attributes

The following table includes the tests which can be used to measure the attributes defined in the Attribute Requirement Inventory. When an "X" appears, it signifies that the name of the test is the same as the name of the ARI attribute. Below are listed the abbreviations used in the table along with the corresponding name of the Test Battery:

ETS - Educational Testing Service (French, Ekstrom, and Price, 1963)

DAT - Differential Aptitude Tests (Bennett, Seashore, and Wesman, 1966)

GATB - General Aptitude Test Battery (U. S. Employment Service)

SVIB - Strong Vocational Interest Blank (Strong, 1966)

OVIS - Ohio Vocational Interest Survey (Ohio Testing Services, 1969)

OIS - Kuder Occupational Interest Survey (Kuder, 1966)

MIQ - Minnesota Interest Questionnaire (Weiss, Dawis, Lofquist, and England, 1966)

ALT - Altman's General Vocational Capability Tests (Altman, 1966)

MAJT - Meier Art Judgment Tests (Meier, 1942)

SMMT - Seashore Measures of Musical Talents (Seashore, 1938)

Table 13. Tests Corresponding to ARI Attributes

Attribute	No(s).	Test Battery							
		ETS	DAT	GATB	SVIB	OVIS	OIS	MIQ	OTHER
Gen. Vocational Capabilities	1-24								ALT
Closure	25	Cf,Cs							
Form Perception	26			X					
Perceptual Speed	27	P		Clerical Perception					
Spatial Scanning	28	X							
Spatial Orientation	29	X							
Visualization	30	X	Space Relations	Spatial					
Number Facility	31	X	Numerical Ability	Numerical					
Memory	32	Ma,Ms							
Verbal Comprehension	33	X	Verbal Reasoning	Verbal					
Grammar	34		X						

Table 13 (continued)

Attribute	No(s).	Test Battery							
		ETS	DAT	GATB	SVIB	OVIS	OIS	MIQ	OTHER
Spelling	35		X						
Expressional Fluency	36	X							
Ideational Fluency	37	X							
Sensitivity to Problems	38	X							
Deductive Reasoning	39	Rs							
Inductive Reasoning	40	I							
Originality	41	X							
Social Intelligence	42								
Aesthetic Judgment	43								MAT
Musical Aptitude	44								SMMT
Manual Work	63					X	Outdoor		

Table 13 (continued)

		Test Battery							
Attribute	No(s).	ETS	DAT	GATB	SVIB	OVIS	OIS	MIQ	OTHER
Machine Work	64					X	Mechanical		
Personal Service	65					X			
Care of People or Animals	66					X			
Clerical Work	67				Office Procedures	X	Clerical		
Inspecting and Testing	68					X			
Crafts and Precise Operations	69				Mechanical	X			
Customer Services	70				Merchandizing	X			
Nursing & Related Tech. Services	71					X			
Skilled Personal Service	72					X			
Training	73				Recreational Leadership	X			
Literary	74				Writing	X	X		

Table 13 (continued)

Attribute	No(s).	Test Battery							
		ETS	DAT	GATB	SVIB	OVIS	OIS	MIQ	OTHER
Numerical	75				Mathematics	X	Computational		
Appraisal	76				Technical Supervision	X			
Agriculture	77				Nature, Agriculture	X			
Applied Technology	78				Science	X	Scientific		
Promotion & Communication	79				Public Speaking	X	Persuasive		
Management and Supervision	80				Business Management	X			
Artistic	81				Art	X	X		
Sales Rep.	82				Sales	X	Persuasive		
Music	83				X	X	Musical		
Entertainment & Performing Arts	84					X			
Teaching, Counseling, & Social Work	85				Teaching	X	Social Service		

Table 13 (continued)

		Test Battery							
Attribute	No(s).	ETS	DAT	GATB	SVIB	OVIS	OIS	MIQ	OTHER
Medical	86				Medical Services	X	Scientific		
Needs	87-103							X	

Appendix B

The Attribute Requirement Inventory

FOR DISCUSSION PURPOSES ONLY

ATTRIBUTE REQUIREMENT INVENTORY

Robert W. Neeb, J. W. Cunningham, and
Thomas C. Tuttle

This work was supported by the research program of the Center for Occupational Education located at North Carolina State University at Raleigh, North Carolina, in cooperation with the Division of Adult, Vocational, and Library Programs, Bureau of Research, U. S. Office of Education.

CENTER FOR OCCUPATIONAL EDUCATION
North Carolina State University at Raleigh
Raleigh, North Carolina

August, 1970

RATING OF WORK ELEMENTS ON HUMAN ATTRIBUTE REQUIREMENTS

INSTRUCTIONS

Materials To Be Used

The Occupation Analysis Inventory (OAI): A 540-item inventory describing work elements under five major headings: Information Input; Mental Processes; Behavioral Output; Work Goals; and Work Context.

Attribute Requirement Inventory (ARI): A 103-item inventory defining human attributes in the following categories: General Vocational Capabilities; Cognitive Abilities; Psychomotor Abilities; Sensory Capacities; Interests; and Needs.

Answer Sheets: Each item on the answer sheets is coded to correspond to an item in the Occupation Analysis Inventory. The scale values "0" to "5" appear in each item on the answer sheets.

What You Are To Do

Steps:

1. First, familiarize yourself with the Occupation Analysis Inventory (OAI) by reading through all of the items (work elements). However, do not confuse the instructions in the front of the OAI booklet with the instructions which you are to carry out.

2. Then, carefully read one of the attribute definitions in the Attribute Requirement Inventory (ARI).

3. Next, read each OAI item (work element) and consider whether or not the ARI attribute in question is relevant to that work element; that is, whether or not the ARI attribute contributes to the worker's performance in dealing with that OAI work element. Then, by circling the appropriate value (0 through 5) on the answer sheet, rate the OAI item on the Degree of Relevance of the attribute in question to the work element described in that OAI item.

When rating OAI items on GENERAL VOCATIONAL CAPABILITIES, COGNITIVE ABILITIES, PSYCHOMOTOR ABILITIES, and SENSORY CAPACITIES, Degree of Relevance (of the attribute to the work element) should be thought of in terms of the level or amount of the human ability or capacity in question required of the incumbent in order for him to deal effectively with the

OAI element, when that work element is a very significant part of the job.*

When rating OAI items on INTERESTS and NEEDS, Degree of Relevance (of the attribute to the work element) should be defined as the extent to which the attribute in question is compatible with the OAI work element; that is, the extent to which a worker who is high on the specified Interest or Need would find satisfaction in dealing with the OAI work element, assuming that work element was a very significant part of his job.*

The scale which you are to use is defined below:

Scale Value	Degree of Relevance
0	Does not apply
1	Very limited relevance
2	Limited relevance
3	Moderate relevance
4	Substantial relevance
5	Very high relevance

4. For each ARI attribute which you are assigned, apply Step 3 (above) to every OAI item.

Caution:

In rating each OAI item, be sure to indicate the contribution of the attribute to the work element described in the item, and not vice versa. For example, if the attribute were the General Vocational Capability, Tools (Attribute 1 in the ARI), and the OAI item were Manual Dexterity (OAI item 5a), a rating of "0" would be assigned, since Manual Dexterity does not require tool skill even though tool skill might require Manual Dexterity. To insure against reversing the direction of a rating, it would be helpful to use the following format in performing a rating:

> "This attribute is of (0-5) Degrees of Relevance in dealing with the work element described in OAI Item _____, when this work element is a very significant part of a job."

---

*An OAI work element is a "very significant" part of a job, when the job receives the highest possible rating (usually a "5") on the OAI item which describes that element. (See Instructions, OAI)

Example:

Suppose you were rating OAI Item 79i, Content or Meaning of Written Verbal Information (turn to this item in the OAI), on the ARI attribute of Verbal Comprehension (see ARI Attribute 33). Since a very high amount of Verbal Comprehension is required in dealing with the Content or Meaning of Written Information when this work element is a very significant part of a job, OAI Item 79i would receive the following rating on the answer sheet:

0 1 2 3 4 [✓ 5]

On the other hand, if you were rating OAI Item 79i (Content or Meaning of Written Verbal Information) on the ARI attribute of Multilimb Coordination (ARI Attribute 46), you would assign a rating of "0" [[✓ 0] 1 2 3 4 5], since Multilimb Coordination is not required in dealing with the Content or Meaning of Written Verbal Information when this work element is a very significant part of a job.

GENERAL VOCATIONAL CAPABILITIES

Knowledges and skills which are relevant to a wide variety of occupations but which are more occupationally specific than basic aptitudes and academic abilities. General vocational capabilities can be thought of as falling on a hardware-to-people continuum divided into the following categories: Mechanical; Electrical; Spatial (including structures and layout and visualization); Chemical-Biological; Symbolic (including numerical operations and verbal communication); and People.

1. Tools: Knowledge and skill in the use of common hand tools, portable power tools and equipment (electrical, gasoline, pneumatic, etc.), and selected special tools including delicate precision tools. Examples of job activities requiring a substantial amount of tool skill and knowledge are: a jeweler cutting a gem; a mechanical assembler using an air screwdriver to emplace screws; a carpenter planing a board for a cabinet; an auto mechanic using wrenches to change sparkplugs; etc.

2. Mechanical Systems: A knowledge of elementary mechanical and physical principles and mechanical components, and skill in applying these to tasks. Included are: the principles of pulleys, screws, and inclined planes; common physical forces; gears and linkages; drive mechanisms; transmission of force and energy; leverage; vibration; friction; hydraulics applied to machines; aerodynamic principles applied to machines; etc. Examples of job activities requiring a substantial amount of mechanical knowledge and skill are: an aircraft mechanic troubleshooting an engine failure; a mechanical engineer installing a pneumatic system; a technician working on a prototype machine; a mechanics physicist researching a new type of rocket control system; etc.

3. Stationary Machine and Equipment Operation: Knowledge and skill in operating stationary equipment such as drill presses, lathes, book binding machines, meat slicers, milling machines, etc. Also includes a knowledge of the principles and safety procedures necessary for such operation. Examples of job activities requiring a substantial amount of this capability are: a lathe operator shaping a chair leg; a shoe repairman grinding down a new sole on a shoe; a punch press operator punching holes in sheet metal; a milling machine operator cutting gear teeth; etc.

4. Vehicular Operation: Knowledge and skill in operating vehicles effectively, including a knowledge of vehicular motion, maintenance, and safety. Besides vehicles such as trucks and cars, mechanized equipment such as bulldozers, road scrapers, steam rollers, cranes, etc., would be included. Examples of job activities requiring a substantial amount of this capability are: a bus driver on his route; a farmer combining wheat; a

highway maintenance man plowing snow off the roads; a crane operator hoisting building materials for a new skyscraper; etc.

5. Connections and Fittings: Knowledge and skill in the use of threads, flanges, solder joints, welds, packing, washers, etc. Examples of job activities requiring a substantial amount of knowledge and skill in the use of connections and fittings are: a solderer soldering a wire to a switch; a plumber installing a sink; a wireman wiring an electric appliance; a welder welding two beams together; etc.

6. Fluid Systems: An understanding of leak detection measures; solid, liquid, and gas transforms; pressure; valves; safety devices; and thermostats. Examples of job activities requiring a substantial knowledge of fluid systems are: a gas-leak locator checking for gas main leaks; a pressure foreman keeping the pressure in a boiler adjusted; an air conditioning repairman testing for freon leaks; etc.

7. Measuring Instruments: Competence in using measuring instruments including a knowledge of units of measurement and conversion of units, tolerances, and principles of measurement and estimation. Such competence would be demonstrated through the use of a voltmeter to check the voltage in a machine; a caliper to size a hole; a dial gauge to check the roundness of a piece of aluminum tubing; a pressure gauge to check the air pressure in a tire; a counting scale to count screws; a transit to survey land; a tape measure to measure the dimensions of a room; etc. Examples of job activities requiring a substantial knowledge of measuring instruments are: a surveyor laying out a plot of land; a weatherman checking temperature and barometric pressure; a quality inspector checking screw sizes with a micrometer; a quality inspector checking rubber hardness with a durometer; etc.

8. Electricity: Knowledge of the principles and concepts of electricity, electro-mechanics, or electronics. Includes knowledge of such things as electrical components; elementary circuits; common electro-mechanical devices and their functions; electro-mechanical circuits; electrical tests; electrical symbols; and safety. Examples of job activities requiring a substantial amount of electrical knowledge and skill are: an electrician wiring a house; a repairman fixing an electronic computer; a television repairman fixing a TV set; an electronics physicist developing a new transistor; etc.

9. Layout and Visualization: Knowledge and skill in doing layouts and drawings including the use of drawing tools, scaling and measuring instruments, labels and dimensions, and basic geometric principles. Includes the ability to take objects, photographs, and drawings and use them in preparing a new drawing or layout. Also important is the ability to visualize the spatial

relationships among objects and parts. Examples of job activities requiring a substantial amount of layout and visualization are: a draftsman drawing a new machine part; a landscaper drawing up a landscape layout; an architect designing a new house; etc.

10. Structures: Knowledge of the accepted standards of structural design including such principles as maximum strength, use of building materials and insulation, maximum weather protection, and removal of damaged structures. Also, the application of basic geometric concepts and elementary drawing techniques to problems of simple structural design and representation; determining relative size of interior and exterior surfaces; and knowledge of forming techniques. Examples of job activities requiring a substantial knowledge of structures are: a carpenter installing a new kitchen; an architect writing specifications for a house; a construction engineer drawing up the details of a new building and writing material and construction specifications; etc.

11. Materials: Knowledge of the characteristics, properties, and uses of common materials. Includes a knowledge of surfaces and their covering (such as wood finishing, floor coverings, etc.), easily damaged materials, strength and pliability of materials, consistency of material, weight and density of material, durability of material, etc. Examples of job activities requiring a substantial amount of knowledge and skill in the use of materials are: a civil engineer writing material requirements for a new bridge; a carpenter deciding what materials to use to finish a new cabinet; a head paint inspector determining what paint to use to cover up a discolored typewriter; etc.

12. Chemicals: Knowledge of common chemicals, chemical components, and their reactions and effects. Would include an understanding of combustion, its products and effects; common laboratory and industrial procedures; chemical cleaners and other chemical agents; etc. Examples of job activities requiring a substantial amount of knowledge in the use of chemicals are: a soil analyst testing soil composition; a chemist carrying out an experiment; a pharmacist preparing a prescription; a textile technician chemically testing cloth to see that it meets specifications; etc.

13. Foods and Cooking: Knowledge and understanding of common foods, their preparation and composition; basic food chemistry; diets; and food sanitation. Also, the ability to schedule cooking operations. Examples of job activities requiring a substantial knowledge of foods and cooking are: a dietician preparing a school menu; a chef supervising the preparation of a meal; a baker baking a cake; etc.

14. Biological Systems: Knowledge of anatomy, physiology, and the functioning of life systems. Would include skill in performing and interpreting common biological and medical laboratory tests; also, knowledge of biological reactions to common substances and chemicals. Examples of job activities requiring a substantial amount of this capability are: a physician interpreting X-rays; a physiologist studying cardiovascular responses in dogs; a medical technologist testing a blood sample; a biologist studying life processes in an amoeba; etc.

15. Medical and First Aid: Knowledge of medical and first aid practices and techniques and skill in using this knowledge in treating patients. Examples of job activities requiring a substantial amount of medical and first aid skills are: a doctor performing an emergency operation; a rescue squad worker administering oxygen; a veterinarian examining a horse with a broken ankle; a nurse giving a tetanus shot; etc.

16. Arithmetic Computation: Skill in carrying out basic arithmetic operations (+, -, ÷, ×) and in applying these to practical problems. Would also include the use of fractions, decimals, percentages, and proportions; computing and bisecting angles; computing lengths using geometric relationships; using exponents; etc. Examples of job activities requiring a substantial amount of this capability are: a draftsman computing scale drawing dimensions; a machinist converting micrometer readings to fractions; an interior decorator figuring material requirements for a new house; a mathematician computing the answer to a problem; etc.

17. Arithmetic Conventions: Skill in using arithmetic and bookkeeping conventions including graphs, tables, charts, ledgers, etc. Also, the application of special purpose symbol systems (such as computer language; debit, credit, and asterisk symbols; etc.) to work situations. Examples of job activities requiring a substantial amount of skill in using arithmetic conventions are: a market analyst preparing tables and charts; an accountant preparing a financial statement; an actuary preparing insurance premium tables; a bookkeeper keeping a ledger; a computer programmer writing a program; etc.

18. Clerical: Knowledge of office routines, letter format, copying, filing procedures, and basic office machine operation (for example, typewriters, adding machines, postage meters); etc. Also, skill in taking notes from oral instruction including understanding and following instructions. Examples of job activities requiring a substantial amount of clerical capability include: a stenographer taking dictation; a typist typing a letter; an office girl filing letters; a secretary proofreading a report; a bank teller entering a deposit; etc.

19. Verbal Communication: Skill in oral and written expression and comprehension including the ability to give effective instructions; write letters and prepare reports; defend opinions; read rapidly with high retention; understand lectures and briefings; speak effectively; etc. Would include knowledge of grammar; punctuation and format; content selection; vocabulary; sentence variety and clarity; correct diction; etc. Examples of job activities requiring a substantial amount of verbal communication skills are: a professor giving a lecture; a writer writing a novel; an executive giving a briefing; an advertising salesman discussing the placement of a magazine ad with new customers; etc.

20. Sales: Skill in assessing customer's needs and then matching customer, product, and sales technique. Includes appropriate use of persuasion and sales procedures, knowledge of customer problems, and the ability to handle merchandising and advertising. Examples of job activities requiring a substantial amount of sales knowledge and skill are: a real estate agent trying to sell a house; a technical salesman selling a copying machine; an advertising manager preparing a magazine ad; etc.

21. Service: Knowledge of your customer's or client's rights and needs and the rules and procedures of effective service, including the ability to use this knowledge to your client's advantage and satisfaction. Examples of job activities requiring a substantial amount of this capability are: a travel agent helping to plan a trip; a headwaiter overseeing the operation of a restaurant; an airline stewardess serving passengers; etc.

22. Dealing with Social Situations: Skill in perceiving social situations correctly and reacting appropriately. This would include skill in dealing with non-routine, awkward, or unusual social situations when they arise. Also includes skill in interpreting gestures, actions, etc. Examples of job activities requiring a substantial amount of skill in dealing with social situations are: a school teacher handling an unruly class; a social worker aiding a poor family; a minister giving advice; an airline pilot trying to reassure passengers on a hijacked airplane; a supervisor handling an employee grievance; etc.

23. Etiquette and Social Grace: Knowledge of the social behavior, manners, and ceremonies established by convention as acceptable in society or in a profession, and the ability to follow these rules. Also, skill in conducting oneself with grace and bearing. Examples of job activities requiring a substantial amount of etiquette and social grace are: a butler serving important guests; a maitre d' carrying out his duties; a ballroom dance teacher giving lessons; a company executive entertaining out-of-town customers; etc.

24. Style and Grooming: Knowledge and skill in proper attire and grooming. Includes skill in enhancing one's own appearance, as well as the appearance of others. Examples of job activities requiring a substantial amount of knowledge and skill in style and grooming are: a model showing clothes; a beautician styling a woman's hair; a barber giving a haircut; a fashion designer designing new clothes; etc.

COGNITIVE ABILITIES

General and relatively stable intellectual capacities involving perceiving, recognizing, remembering, conceiving, reasoning, creative thinking, judging, etc. Cognitive abilities are prerequisite to performance on a wide variety of specific tasks. A distinguishing characteristic of cognitive abilities--in comparison to psychomotor abilities and affective states (such as needs and interests)--is a relatively high state of consciousness or awareness of one's behavior.

25. Closure: The ability to organize a disorganized or ambiguous visual field into a single percept or impression, with or without knowledge of any of the specific configurations contained in the field. Examples of job activities requiring a substantial amount of closure are: an aerial-photograph interpreter examining a photograph for camouflaged military installations; a technician examining cell patterns under a microscope; an astronomer interpreting celestial phenomena; etc.

26. Form Perception: The ability to perceive pertinent detail in objects or in pictorial or graphic material; to make fine visual comparisons and discriminations among characteristics such as shapes and shadings of figures or objects and widths and lengths of lines. Examples of jobs activities requiring a substantial amount of form perception are: a fingerprint classifier comparing fingerprints; a hand decorator painting designs on pottery; a topographical draftsman distinguishing terrain features on maps; etc.

27. Perceptual Speed: The ability to rapidly perceive pertinent detail in verbal or tabular material and to rapidly perform simple visual discrimination tasks. This would include such tasks as proofreading, making comparisons of written material, discriminating between symbols, detecting differences in copy, etc. Examples of job activities requiring a substantial amount of perceptual speed are: a proofreader checking a proof against the original copy; a stenographer typing a letter from shorthand notes; a bookkeeping-machine operator transposing information from sales slips or invoices to the machine; etc.

28. Spatial Scanning:[3] Speed in visually exploring a wide or complicated field with the objective of identifying or detecting objects. Examples of job activities requiring a substantial amount of spatial scanning are: a radar operator looking for unidentified objects on a radar screen; a forest ranger spotting forest fires; an insurance underwriter looking for an insurance premium in an actuarial table; etc.

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[3] This item is a modification of an original item used in the present study.

29. Spatial Orientation: The ability to perceive spatial patterns and to orient oneself in relation to the position and configuration of surrounding objects. Examples of job activities requiring a substantial amount of spatial orientation are: a single engine airplane pilot making a landing; a motor launch operator conducting a tour of a lake; a mountain climber climbing a mountain; etc.

30. Visualization: The ability to comprehend spatial patterns in two or three dimensions and to mentally manipulate or transform them into other spatial patterns; the ability to visualize objects of two or three dimensions; to think visually of geometric forms. (For example, to see a three-dimensional drawing of a square with various sides shaded and to be able to visualize how that square would look if it were opened up and laid out flat.) Visualization differs from spatial orientation in that in visualization the observer is removed from the spatial pattern, whereas in spatial orientation he is the center of the pattern. Examples of job activities requiring a substantial amount of visualization are: a dentist using a mirror to fill a tooth; an architect sketching a proposed building; an artist painting a landscape; etc.

31. Number Facility: The ability to manipulate numbers in arithmetical operations (especially addition, subtraction, multiplication, and division) rapidly and accurately. Number facility also includes counting, plotting on numbered coordinates, etc. Examples of job activities requiring a substantial amount of number facility are: an insurance underwriter computing compound interest and premium rates; a chemist computing the answer to a mathematical equation; a bookkeeper adding or subtracting debits and credits; a draftsman computing scale representations of objects; etc.

32. Memory: The ability to mentally store pertinent information and to recall it perfectly for reproduction within a short period of time (one minute to eight hours). Examples of job activities requiring memory are: a telephone operator remembering names of people, companies, telephone numbers, etc.; a taxicab driver remembering dispatch addresses; a student cramming for an exam at the last minute; a politician giving an acceptance speech from memory; etc.

33. Verbal Comprehension: The ability to understand meanings of words and the ideas associated with them, and to use them effectively; the ability to comprehend language, to understand relationships between words, and to understand meanings of whole sentences and paragraphs. Examples of job activities requiring a substantial amount of verbal comprehension are: a case worker preparing a case history; a civil lawyer preparing a case; a newspaper editor writing an editorial; a research engineer reviewing a technical report; etc.

34. Grammar: The ability to deal with forms and structures of words and their customary arrangement in phrases and sentences. Included is the ability to recognize good and bad grammar and to recognize correct punctuation and word usage. Examples of job activities requiring a substantial knowledge of grammar are: an editor checking a manuscript; an advertising manager preparing an ad; an English teacher reading term papers; etc.

35. Spelling: The ability to use letters properly to form words. Spelling also includes the ability to distinguish between correctly spelled and misspelled words. Examples of job activities requiring a substantial knowledge of spelling are: a proofreader checking type script; a secretary checking a letter before it goes out; a stenographer typing a letter from shorthand; a technical writer preparing a report; etc.

36. Expressional Fluency: The ability to rapidly put ideas into words, especially in oral or written connected discourse. Expressional fluency differs from ideational fluency (below) in that expressional fluency does not involve coming up with ideas (as does ideational fluency) but, rather, the verbal expression of these ideas. Examples of job activities requiring a substantial amount of expressional fluency are: a lawyer questioning a witness; a politician in a nationally televised debate; a newspaper reporter writing an article; etc.

37. Ideational Fluency: The ability to rapidly produce ideas about a given topic where quantity rather than quality of ideas is stressed (for example, producing as many ideas as possible about a given topic in five minutes). Examples of job activities requiring a substantial amount of ideational fluency are: a marketing manager throwing out ideas about naming a new product; an advertising agent giving suggestions for a new mailer; an automotive engineer suggesting style changes for next year's cars; etc.

38. Sensitivity to Problems: The ability to recognize practical problems (for example, improvements that could be made in electrical appliances, etc.); deficiencies in courses of action or organizational plans (for example, why a road should not be repaved when it would have to be torn up in the near future to install new sewer pipes); or implications of activities (for example, if the activity is building a dog house, the ability to infer that the entrance must be large enough to accommodate the dog, that the roof should be slanted so that rain will run off, that the entrance should be pointed away from the normal direction of the wind, etc.). Examples of job activities requiring a substantial amount of sensitivity to problems are: an industrial consultant investigating decreasing production in a company; a civil engineer evaluating a plan to build a new super highway; a building contractor planning the construction of a new house; a high school teacher trying to

anticipate the problems that could arise on a planned class trip and also, what measures to take if such problems do arise; etc.

39. Deductive Reasoning: The ability to take given premises and reason to their necessary conclusion. For example, given: "All holidays are paid and no Sundays are paid," the ability to deduce that "No Sundays are holidays." Examples of job activities requiring a substantial amount of deductive reasoning are: a district attorney prosecuting a case; an electronic troubleshooter trying to solve a novel computer problem; a mathematician solving a problem; etc.

40. Inductive Reasoning: The ability to take specific sets of information and to generate or conceive of general concepts which give structure and meaning to the information; that is, finding a general concept, principle, rule, or hypothesis to explain a set of specific instances. This factor is tested for by requiring the examinee to derive a principle from a number of particular instances. (For example, given the nonsense syllables ABC, MNO, XYZ, PQS, GHI, the ability to discover that PQS is different from the others, since the rule for the formation of the others is alphabetical order.) Includes the ability to discern basic differences and relationships among symbols, figures, and figure patterns (usually measured through the use of figure diagrams arranged in accordance with underlying principles). Examples of job activities requiring a substantial amount of inductive reasoning are: a physicist developing a theory to explain a series of laboratory findings; a cryptanalyst decoding a secret message; a bio-chemist breaking down DNA codes; a social psychologist formulating a theory to explain voting behavior; etc.

41. Originality: The ability to produce responses or ideas which are either clever or uncommon. For example, the ability to produce clever titles to story plots or to produce novel consequences of a hypothetical situation (such as what if everyone went blind). Examples of job activities requiring a substantial amount of originality are: an advertising manager producing a new twist for an ad; a marketing manager thinking of an unusual name for a new product; a cartoonist drawing a satirical cartoon; etc.

42. Social Intelligence: The ability to correctly process behavioral information obtained through social interaction. Includes an awareness of, or sensitivity to, the behavioral indicators of attention, thoughts, desires, moods, emotions, intentions, etc. Such behavioral indicators include gestures, postures, actions, expressions, voice inflections, etc. Examples of job activities requiring a substantial amount of social intelligence are: a politician campaigning for office; a shop foreman supervising

his subordinates; a nurse working with elderly patients in a nursing home; a salesman varying his sales approach according to customer reaction; etc.

43. Aesthetic Judgment: The ability to make judgments concerning the compositional organization of art objects on the basis of variations in unity, proportion, form, color, and design. Examples of job activities requiring aesthetic judgment include: an art teacher criticizing students' work; an art appraiser determining the value of a painting; an artist painting a picture; a sculptor carving a design in stone; an architect judging the aesthetic quality of a design; etc.

44. Musical Aptitude: Musical aptitude consists of a combination of sensory, psychomotor, and cognitive capabilities which have been found to underlie success in music. These capacities include sense of pitch, rhythm, time, and tonal memory. Job activities requiring musical aptitude are: playing a musical instrument; singing; directing an orchestra; judging a music contest; etc.

PSYCHOMOTOR ABILITIES

Capacities involving bodily or muscular movement, usually in coordination with the sensory processes.

45. Control Precision: The ability to make rapid, yet precise, highly controlled muscular movements to adjust the position of a control mechanism (such as joysticks, levers, pedals, rudders, etc.). The adjustments are made through the use of either the arm and hand or leg and foot. Many adjustments may be required, with the number and magnitude determined through feedback of the effectiveness of previous adjustments. Examples of job activities requiring a substantial amount of control precision are: an airline pilot operating a joystick to steer an aircraft; a lathe operator manipulating the die, through the use of a lever, to shape a chair leg; a crane operator positioning a building section; etc.

46. Multilimb Coordination: The ability to use more than one limb (both hands, both feet, or hands and feet) simultaneously, in a coordinated manner. Examples of job activities requiring a substantial amount of multilimb coordination are: manually changing gears on an automobile using the shift and clutch; playing baseball; playing a piano; etc.

47. Reaction Time: The ability to respond rapidly to a stimulus when it appears. Examples of job activities requiring a substantial amount of reaction time are: using the brakes of an automobile so as not to hit a child; stopping an electronic card sorter when a card jams; reacting to the starting gun at a track or swim meet; etc.

48. Eye-Hand Coordination: The ability to make rapid and accurate hand movements in coordination with visual stimuli. This ability is tested for by requiring the examinee to place dots in small circles as rapidly as possible. Examples of job activities requiring a substantial amount of eye-hand coordination are: a switchboard operator connecting a call by placing the correct wire in the correct hole; a bricklayer laying bricks; a mechanical assembler soldering wires together; etc.

49. Manual Dexterity: The ability to make rapid and accurate arm-hand movements in manipulating fairly large objects. Examples of job activities requiring a substantial amount of manual dexterity are: a mechanic tuning a car; a sewing machine operator making a dress; a gift wrapper wrapping gifts in a clothing store; etc.

50. Finger Dexterity: The ability to make precise manipulations of small objects with the fingers. Examples of job activities requiring a substantial amount of finger dexterity are: a

surgeon performing a critical operation; a watchmaker assembling a watch; an engraver cutting designs in jewelry; a repairman rewiring an appliance; etc.

51. Arm-Hand Steadiness: The ability to make precise arm-hand positioning movements and to maintain steadiness while making these movements, where strength and speed are unimportant. Also, the ability to minimize movement while the arms and hands are in a set position. Examples of job activities requiring a substantial amount of arm-hand steadiness are: an artist painting a picture; a policeman firing a pistol; a chemist transferring liquids from one test tube to another; a make-up artist lining an actor's face; etc.

52. Explosive Strength: The ability to apply a maximum amount of force through one or more short bursts of effort. Examples of job activities requiring a substantial amount of explosive strength are: a construction worker driving a metal stake into the ground; a carpenter sawing a piece of wood; a sailor throwing a line to shore; etc.

53. Static Strength: The ability to exert considerable force against external objects for a brief period, as in lifting, pushing, pulling, squeezing, carrying, etc. It applies to different muscle groups (hand, arm, back, shoulder, leg) and to different kinds of tasks. Examples of job activities requiring a substantial amount of static strength are: a moving man moving furniture; a laborer loading 100 pound sacks of concrete on a truck; a weightlifter lifting weights; a longshoreman unloading boats; a construction worker using bolt cutters to cut up heavy metal rods; etc.

54. Dynamic Strength: The ability to exert force repeatedly or continuously over time so as to move or support the body. Muscular endurance and resistance to muscular fatigue are important in this ability. Examples of job activities requiring a substantial amount of dynamic strength are: a ballerina performing; a gymnast performing on the horizontal bar; an assembler using a screwdriver constantly to emplace screws; etc.

55. Body Equilibrium: The ability to maintain or regain body balance and orientation when equilibrium is threatened or temporarily lost, placing primary reliance on nonvisual cues (for example, kinesthetic and vestibular cues). Examples of job activities requiring a substantial amount of body equilibrium are: painting from a ladder; walking on a steel beam; climbing a telephone pole to do repair work; installing an antenna on an A-frame house; etc.

56. Stamina: The ability to exert the body through continuous effort over an extended period of time (cardiovascular endurance). Examples of job activities requiring a substantial amount of stamina are: fighting a fire; digging irrigation ditches; running cross country; etc.

SENSORY CAPACITIES

Capabilities involving use of sense organs.

57. Near Visual Acuity: The ability to visually discriminate detail at normal reading distance or less. Examples of job activities requiring a substantial amount of near visual acuity are: a jeweler cutting a gem; a handcarver carving small figurines; an editor proofreading an editorial; etc.

58. Far Visual Acuity: The ability to perceive detail at distances beyond normal reading distance. Examples of job activities requiring a substantial amount of far visual acuity are: a forest ranger spotting forest fires; a store detective watching for shoplifters; a crane operator moving building materials; an airplane pilot searching for wreckage of another airplane; a truck driver making deliveries; etc.

59. Depth Perception: The ability to perceive distances, such as: from the observer to an object; between objects along the observer's line of vision; from the front to the back of an object so that it is seen three-dimensionally; etc. Examples of job activities requiring a substantial amount of depth perception are: an airplane pilot making a landing; moving objects with a forklift; painting a landscape; etc.

60. Color Discrimination: The ability to perceive similarities or differences in colors. Includes the ability to identify a particular color, recognize harmonious or contrasting color combinations, or to match colors adequately. Examples of job activities requiring a substantial amount of color discrimination are: an artist painting a portrait; an interior decorator choosing color schemes; a glazier artist selecting glass for a stained glass window; etc.

61. Auditory Acuity: The ability to perceive relevant sound cues and to discriminate between sounds in terms of their intensity, pitch, or tonal quality. Examples of job activities requiring a substantial amount of auditory acuity are: a piano tuner tuning a piano; a general practitioner examining a patient's chest with a stethoscope; a night watchman listening for intruders; a telephone operator taking phone numbers; etc.

62. Tactual Discrimination: The ability to discriminate characteristics of objects (such as size, shape, texture, etc.) through the use of touch. Examples of job activities requiring a substantial amount of tactual discrimination are: a surgeon performing a heart operation; a sculptor modeling a small plastic statue; a cloth examiner inspecting cloth by feeling for defective weaving; etc.

INTERESTS[4]

Preferences for, attractions toward, or likings of various classes of activities and the contexts associated with these activities. Interests are measured by questions concerning the examinee's preference for or strength of attraction toward such things as job activities, hobbies, recreational pursuits, and leisure activities.

63. Manual Work: This interest area involves a preference for the following types of work activities: (1) use of the hands and body and sometimes the use of hand tools to work, move, guide, or place objects and materials; (2) activities which are routine and usually do not require following strict standards or detailed instructions; (3) feeding or off-bearing from automatic machines, or machines operated by other workers; (4) stopping, starting, or watching the operation of machines, setting guides, pushing buttons or making other pre-determined adjustments. Examples of jobs for which this interest is important include: groundskeeper; small parts assembler; conveyor loader; poultry dresser; garment folder; automatic sewing machine operator; parking meter collector; thread winder; machine feeder; etc.

64. Machine Work: Preference for work activities which involve fine work with hands, hand tools, stationary and nonstationary machines as well as activities in which the responsibility for a good job rests with the worker who must exercise good judgment in selecting, using, and caring for tools and machines. Work activities involving stationary machines include: (1) setting up and adjusting the machine; (2) selecting the proper parts and tools; (3) observing and adjusting the operation; (4) making minor repairs; (5) performing other operations including stopping the machine, removing the product, and checking its accuracy using blueprints or specifications. Work activities performed on nonstationary machines include: (1) starting and stopping; (2) steering; (3) operating various controls; (4) occasionally performing at the signal of others. Jobs for which this interest is relevant include: butcher; machine assembler; thermostat repairman; mold setter; labeling machine set-up man; dry cleaner; offset pressman; sewing machine operator; bulldozer operator; conveyor operator; etc.

65. Personal Service: Preference for work activities involving direct contact, communication, or close association with those being served. Types of personal service involved include: (1) modeling; (2) protecting people and property; (3) selling commodities such as newspapers and sundries; (4) serving food; (5) chauffering; (6) delivering messages. Examples of jobs for which this interest is relevant include: model; lifeguard; restaurant hostess; bartender; doorman; telegraph messenger; etc.

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[4] The interest definitions (Items 63-86) were adapted from Ohio Vocational Interest Survey, copyright 1969 by Harcourt Brace Jovanovich, Inc. Adapted by special permission of the publisher.

66. Care of People or Animals: Preference for work activities which involve taking care of people or animals. Work activities related to care of people include: (1) taking care of the safety, health, and personal hygiene of children and/or those who are ill; (2) feeding; (3) dressing; (4) bathing; (5) reading to; (6) otherwise maintaining the comfort of the person. Work activities related to the care of animals include: (1) handling and exercising; (2) feeding and watering; (3) training; (4) grooming; (5) treating for minor illness and injury. Examples of jobs for which this interest is relevant include: practical nurse; child-care attendant; orderly; horse exerciser; dog groomer; pet shop attendant; etc.

67. Clerical Work: Preference for work activities which involve general office work. Work activities include: (1) sorting, classifying, recording, and filing records, reports, correspondence; (2) keeping records according to some already established plan or system; (3) typing, taking and transcribing shorthand; (4) operating business machines or calculating machines. Examples of jobs for which this interest is relevant include: music librarian; file clerk; stenographer; bookkeeper; production clerk; medical-record clerk; proofreader; meter reader; typist; key punch operator; etc.

68. Inspecting and Testing: This interest area involves a preference for the following types of work activities: (1) examining materials and supplies and keeping inventory records; (2) using precision measuring instruments such as gauges, calipers, micrometers, or test apparatus for the purpose of grading, sorting, detecting flaws, or checking to make sure that products meet specified standards; (3) performing laboratory or other scientific tests according to standardized procedures. Examples of jobs for which this interest is important include: fire inspector; battery tester; sorter; thermostat adjuster; scientific helper; meat grader; weaving inspector; quality-control technician; etc.

69. Crafts and Precise Operations: Preference for work activities which involve the application of high level manual skills and an organized body of knowledge to one or more of a wide variety of crafts and precision operations. Work activities involving crafts and precise operations interests include: (1) operation of radio, television, and motion picture equipment; (2) precision operation of machine tools; (3) application of skills and knowledge regarding tools and materials to construction, fabricating, and maintenance crafts; (4) set-up, operation, and maintenance of data-processing, type-setting, duplicating, and similar machines; (5) precision operation of diesel, gasoline, steam, or electric powered vehicles or equipment to test their performance, transport cargo, or provide special services. Examples of jobs for which this interest is important include: digital-computer operator; jeweler; carpet layer; plumber; test pilot; motion picture projectionist; radio station operator;

auto mechanic; machinist; carpenter; hand engraver; watch assembler; electrician; etc.

70. Customer Services: Preference for work activities which involve providing services to people in a variety of business situations. Knowledge of the product or techniques of service and the ability to deal with people are important. Work activities involving customer services include: (1) receiving money and keeping records of the transactions; (2) transporting passengers or merchandise; (3) collecting, organizing, and dispensing information; (4) operating a telephone switchboard, taking messages and supplying information; (5) demonstrating and selling products to customers; (6) providing other public services. Examples of jobs for which this interest is important include: receptionist; ticket agent; teller; sales attendant; taxi driver; cashier-checker; dispatcher; recreation facility attendant; etc.

71. Nursing and Related Technical Services: Preference for work activities which involve caring for the sick and injured and providing nursing services concerned with the prevention of illness and the promotion of good health. These activities are, in most cases, performed under the supervision of a doctor or other specialist. Work activities involving nursing and related technical services include: (1) the use of X-ray and other medical laboratory equipment for diagnostic or therapeutic purposes; (2) providing physical therapy through exercise; the use of mechanical apparatus; or the application of heat, light, water, or electricity. Examples of jobs for which this interest is important include: office nurse; dental hygienist; X-ray clerk; physical therapist; audiometrist; surgical technician; etc.

72. Skilled Personal Services: This interest area involves a preference for the following types of work activities: (1) providing skilled services such as tailoring or altering clothing to fit the wearer; (2) planning and preparing meals in homes, restaurants, or other eating places; (3) providing services related to the care and physical appearance of people such as barbering, treatment of skin and nails, make-up analysis, and cosmetology. Examples of jobs for which this interest is important include: dressmaker; cook; barber; manicurist; cosmetologist; costumer; etc.

73. Training: Preference for work activities which involve the training of people, or sometimes animals, in a variety of settings and for a variety of purposes. The trainer or instructor must himself be skilled in the area of work which he is teaching and be able to examine and evaluate the progress of his trainee. Work activities involving training include: (1) training individuals in the organization, policy, regulations, procedures, and methods of work in a business or industry; (2) teaching recreational or hobby activities; (3) training animals for show or performance; (4) training guide dogs; (5) providing instruction in such

fields as flying, boating, etc. Examples of jobs for which this interest is important include: police academy instructors; flying instructors; camp counselor; dog trainer; YMCA leader; bus driving instructor; training supervisor; etc

74. Literary: This interest area involves a preference for the following types of work activities which often require a high degree of abstract-verbal ability: (1) preparing correspondence, reports, legal and business documents, or written descriptions of technical operations and processes; (2) doing creative writing and editing; (3) translating from one language to another; (4) conducting and reporting research investigations in the political, social, and psychological sciences. Examples of jobs for which this interest is important include: claim examiner; job analyst; poet; censor; foreign-news translator; historian; editorial writer; law clerk; political scientist; technical writer; etc.

75. Numerical: This interest area involves a preference for the following types of work activities: (1) applying the principles of accounting, cost analysis, and statistical analysis to problems of business management, including (a) advising, accounting, and auditing systems and procedures, (b) evaluating costing methods, and (c) collecting and analyzing business data; (2) investigating such areas as the theoretical aspects of physics and mathematics; atmospheric, astronomical and geographic phenomena and conditions; and automatic data-processing systems and programs, including (a) analyzing data-processing problems, (b) formulating and testing theories, and (c) developing new mathematical and statistical methods. Examples of jobs for which this interest is important include: tax accountant; appraiser; auditor; actuary; business programmer; meteorologist; mathematician; statistician; etc.

76. Appraisal: This interest area involves a preference for the following types of work activities: (1) applying engineering knowledge to the planning, installation, direction, and operation of projects and systems in a specific field of engineering such as civil, mechanical, chemical, electrical, or industrial; (2) carrying out appraising, analytical, or investigating work related to surveying, exploring, mining, construction, merchandising, or materials analysis. Examples of jobs for which this interest is important include: cost-analysis engineer; space analyst; surveyor; gemologist; real estate appraiser; quality-control engineer; mining investigator; weather observer; water purification chemist; sanitary inspector; insurance claims adjuster; building construction inspector; etc.

77. Agriculture: This interest area involves a preference for the following types of work activities: (1) farming; (2) gardening; (3) animal herding; (4) applying the principles of chemistry, physics, biology, and genetics to scientific agriculture so as to advance man's knowledge of agricultural principles. Examples

of jobs for which this interest is important include: flower grower; dairy farmer; botanist; zoologist; forester; landscaper; soil conservationist; animal breeder; etc.

78. Applied Technology: Preference for work activities which involve applying engineering and research principles and knowledge to the design of new structures, machines, and tools, and to the development or evaluation of new techniques, processes, and products; working in the translation of ideas, sketches, or specifications into complete and accurate working plans; or applying engineering and related technical knowledge in such specialized fields as research, design, and development. Examples of jobs for which this interest is important include: architect; civil engineer; mechanical draftsman; electronic technician; geologist; mechanical engineer; organic chemist; physicist; electrical engineer; etc.

79. Promotion and Communication: This interest area involves a preference for the following types of work activities: (1) planning, directing, and conducting advertising and public relations programs; (2) writing or editing material designed to influence or inform the public; (3) gathering newsworthy information and writing related articles for publication or presentation via radio or TV; (4) performing legal or related work; (5) conducting investigations and examinations or enforcing laws and regulations; (6) negotiating contracts or promoting the interests of individuals or organizations; (7) performing such executive secretarial tasks as making appointments, handling telephone calls, and performing minor executive duties, in addition to taking and transcribing dictation or initiating correspondence. Examples of jobs for which this interest is important include: lobbyist; business agent; placement officer; legal secretary; disc jockey; patrolman; judge; columnist; news reporter; booking agent; personnel recruiter; lawyer; public relations man; journalist; etc.

80. Management and Supervision: Preference for work activities which involve the formulation and administration of management policies and procedures or the supervision, control, and coordination of a wide variety of work activities. Involved are examining methods, procedures, or problems and recommending improvements or solutions. Examples of jobs for which this interest is important include: sales manager; police chief; production supervisor; postmaster; foreman; school superintendent; library director; hotel manager; air-traffic coordinator; chef; etc.

81. Artistic: Preference for work activities which involve the creative expression of ideas, feelings, and moods. The worker must be talented in his area of specialization. At times, the worker consults with customers or consumers. Work activities involving artistic interests include: (1) producing decorative or artistic effects through clothing design, interior decoration,

commercial art, etc.; (2) photographing people, objects, or materials with still or motion picture cameras; (3) creating fine art such as painting and portraiture, sculpture, ceramics, and murals; (4) arranging, decorating, or restoring objects and materials to produce an acceptable artistic effect or product. Examples of jobs for which this interest is important include: set director; commercial photographer; illustrator; artist; interior decorator; cameraman; furniture designer; sculptor; taxidermist; sign writer; etc.

82. Sales Representative: Preference for work activities which involve sale and installation of products or services and may include the servicing of machines or equipment sold. Work activities involving sales interests include: (1) applying a knowledge of engineering and business principles, customer problems, marketing conditions, and product design and function to sales and service work; (2) making appointments; (3) visiting customers; (4) working with customers to solve technical problems; (5) working out comparative cost factors. Examples of jobs for which this interest is important include: sales engineer; buyer; service engineer; insurance salesman; purchasing agent; manufacturer's field representative; home-service representative; etc.

83. Music: Preference for work activities which involve performing or creating in the field of music. Work activities involving music include: (1) singing or directing others in singing; (2) entertaining audiences by playing musical instruments or conducting orchestras; (3) composing or arranging instrumental or vocal music. Examples of jobs for which this interest is important include: orchestra leader; concert singer; arranger; composer; choral director; etc.

84. Entertainment and Performing Arts: Preference for work activities which involve entertaining others. Work activities involving entertaining and performing include: (1) creating and performing original acts or interpreting stock routines in an original style; (2) performing in a dramatic production before a live audience or television or motion picture cameras; (3) performing in rhythmics and dance, individual or team sports, or exibitions of unusual or distinctive skills; (4) explaining or presenting some type of entertainment or diversion such as a stage show, contest, or game of chance. Examples of jobs for which this interest is important include: comedian; actor; dancer; athlete; ring master; show girl; acrobat; magician; side-show operator; etc.

85. Teaching, Counseling, and Social Work: This interest area involves a preference for the following types of work activities: (1) teaching elementary school; (2) teaching academic or vocational subjects at the high school, college, or graduate level; (3) instructing in the theater, fine arts, or sports and physical

development; (4) planning, organizing, and conducting educational programs in a specialized field such as nursing or medical technology; (5) providing guidance counseling and welfare services to individuals or groups in the solution of occupational, educational, personal, or social problems. Examples of jobs for which this interest is important include: music teacher; caseworker; clergyman; home economist; university faculty member; athletic coach; kindergarten teacher; county agricultural agent; psychologist; etc.

86. Medical: Preference for work activities which involve the application of knowledge of medical science to the diagnosis, prevention, and treatment of human or animal diseases, disorders, and injuries. Work activities involving specialized medical applications include: (1) surgery; (2) conducting research and devising programs to protect workers in various settings from health hazards; (3) planning, organizing, and directing or conducting programs designed to aid in the rehabilitation of the physically or mentally ill or handicapped. Examples of jobs for which this interest is important include: oral surgeon; dentist; veterinarian; optometrist; recreational therapist; pediatrician; general practitioner; radiologist; audiologist; etc.

NEEDS[5]

Preferences, desires, or felt wants for various classes of outcomes and conditions which, for the respondent, are associated with satisfaction or reward. Needs are usually measured by questions concerning the examinee's preference for or strength of attraction toward specified outcomes or conditions.

87. Ability Utilization: The need to do work that makes full use of one's abilities; work that is challenging in terms of skill, knowledge, or mental ability. (Think in terms of the abilities of the "average man.")

88. Achievement: The need to feel a sense of accomplishment in one's work.

89. Activity: The need to keep busy through physical activity, job-related social contact, or mental activity.

90. Advancement: The need to occupy a position which offers opportunity for promotion or other forms of advancement.

91. Authority: The need to direct or supervise the activities of others.

92. Compensation: One's need to feel that he is being well rewarded through pay and benefits in comparison to other persons with his ability and education.

93. Co-Workers: The need to occupy a position which allows social interaction and the opportunity to establish friendships with one's co-workers.

94. Creativity: The need to apply one's initiative, ingenuity, and creativity to the work situation; to produce new and original products and ideas; to apply one's own ideas.

95. Independence: The need to plan, direct, and carry out one's own activities rather than be directed by others.

96. Moral Values: The need to avoid a work situation which conflicts with commonly accepted moral and social values.

97. Recognition: The need for explicit acknowledgement or appreciation for one's work accomplishments. Recognition can come from within one's organization (*e.g.*, from management or one's peers) or from outside the organization (*e.g.*, from the community, from professional organizations, etc.).

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[5] The need definitions (Items 87-103) were adapted from the *Manual for the Minnesota Importance Questionnaire*, copyright 1971 by the Work Adjustment Project, Industrial Relations Center, University of Minnesota. Adapted by special permission of the publisher.

98. Responsibility: The need to use one's own judgment, to make decisions, and to be accountable for the effects of one's decisions and actions.

99. Security: The need to be assured that one's job or income is steady and does not depend upon seasonal fluctuations, fluctuations in the economic situation, etc.

100. Social Service: The need to work with people to improve their well-being; the need to do things for others.

101. Social Status: The need to hold a position of prestige or standing in the community by virtue of one's job position or occupation.

102. Variety: The need to perform a number of different job activities rather than one or two activities repeatedly; to have new tasks to perform from day to day.

103. Working Conditions: The need to work in an environment with acceptable or pleasant physical working conditions, including such factors as freedom from hazards, comfortable temperature, proper illumination, low noise level, necessary equipment, attractive surroundings, etc.

Appendix C

Attribute-Requirement Profiles of the OAI Work Elements

Table 14. Attribute Requirement Profiles of OAI Work Elements[a]

```
                                  ATTRIBUTE

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Table 14 (continued)

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Table 14 (continued)

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Table 14 (continued)

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Table 14 (continued)

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Table 14 (continued)

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Table 14 (continued)

```
                                 ATTRIBUTE

         0000000000000000000000000000000000000000000000000000
         0000000001111111111222222222233333333334444444444555
ITEM     1234567890123456789012345678901234567890123456789012

  7T     4100300000100010000000010000000000000000000011134331
  8T     4000110000310010000000000000100000000000000011034120
  9T     4000000000300000000000000000000000000000000011034111
 10T     4000000000200000000000000000000000000000000011034111
 11T     4000010001200000000000001200010000000000000011033120
 12T     5100000001200000000000001300010000000000000011044122
 13T     5100000001200000000000000000000000000000000011134121
 14T     4100000000100000000000000000000000000000000012034120
 15T     3000000000110000000000000001100000000000000002024110
 16T     4100000000100000000000000001100000000000000002024112
 17T     2100000000000000000000000001200100000000000012244023
 18T     4100001000000351000000000000000100000000000011134330
 19T     1000000000000000000000000000000000000000000000000000
 20T     5100000010000110000000010201000100000100000011044450
 21T     5110000100200000000000000000000000000000000011134020
 22T     5110000100200000000000010100000000000000000011134030
 23T     5110000100200000000000010100000000000000000011134020
 24T     5110000100200000000000000100000000000000000011134020
 25T     5010200000200000000000000100000000000000000011134030
 26T     5010500100200000000000000000000000000000000011133020
 27T     5010400100210000000000000000000000000000000011133020
 28T     5110300100200000000000010000000000000000000011133120
 29T     5110500101200000000000000000000000000000000011133120
 30T     3000110000210000000000000001100000000000000011123120
 31T     4110000100200000000000000000000000000000000011123010
 32T     4110000100200000000000000000000000000000000011123110
 33T     5110000100200000000000000000000000000000000011133030
 34T     5110100101200000000000000100010000000000000011134020
 35T     5110000100200000000000000000000000000000000011123020
 36T     4010010100200000000000000000000000000000000011023010
 37T     4110000000000000000000000000100000000000000011123010
 38T     2100000000000000000000000001100000000000000011133120
 39T     4110001100000351000000000000000100000100000011123010
 40T     1000000000000000000000000000000000000000000000000000
 41T     4100100000000110000000000100000100000100000021043340
 42T     2100200000000000000000000000000000000100000000012100
 43T     2100000001000000000000000000100000000100000001012000
 44T     2000100000000000000000000000000000000000000000011000
 45T     1100000000000000000000000000100000000000000001022011
 46T     0000000000000000000000000000000000000000000000000000
 47T     3150000100200000000000000100000000000000000011133010
 48T     3150000100200000000000000000000000000000000011133010
 49T     3150000100200000000000000000000000000000000011133020
```

Table 14 (continued)

```
                              ATTRIBUTE

         000000000000000000000000000000000000000000000001111
         555555566666666667777777777888888888899999999990000
ITEM     345678901234567890123456789012345678901234567890123

  7T     100130200232000030120000000000000211100000000000000
  8T     110131220242000030110000000020000111100000000000000
  9T     110121100332000030010000000010000001100000000000000
 10T     110120200231000030000000000010000001100000000000000
 11T     010130200323000030000000000020000111100000000000000
 12T     110131200322000030000000000020000011100000000000000
 13T     110131200132000030000000000000000011100000000000000
 14T     220121200242000020020000000000000201100000000000000
 15T     110121100141000010110000000000000101100000000000000
 16T     220211200151000010000000300000000001100000000000000
 17T     210122401121000010000000000000030011110000000000000
 18T     000030202211020010400000000000000411100000000000000
 19T     000000000000000000000000000000000000000000000000000
 20T     000051300412010140310000010030000432100000000000000
 21T     110131201133000030000000100000000011100000000000000
 22T     110131201133010030020000100000000011100000000000000
 23T     100131201133000020020000000000000011100000000000000
 24T     000130201123000030000000000000000011100000000000000
 25T     010130200123000030000000000000000011100000000000000
 26T     000130200123000030000000000000000011100000000000000
 27T     000130200123000030000000000000000011100000000000000
 28T     000030200134000020020000000000000011100000000000000
 29T     120030201124000030000000000000000011100000000000000
 30T     000031120123000030000000000020000011100000000000000
 31T     100021101223000030000000000000000011100000000000000
 32T     100021101123000020000000000000000011100000000000000
 33T     100030201124000030000000000000000211100000000000000
 34T     100030200224000030000000000000000011100000000000000
 35T     100020200223000030000000000000000011100000000000000
 36T     000021110123000020010000000000000011100000000000000
 37T     110011200133000010000000200000000011100000000000000
 38T     000022301122000010000000000000020011110000000000000
 39T     000021100113010010200000000000000411110000000000000
 40T     000000000000000000000000000000000000000000000000000
 41T     000050300413010150010000010010000432110000000000000
 42T     000021100131000020000000000010000010000000000000000
 43T     001012200131000020000000000000000000000000000000000
 44T     000020100132000020000000000000000000000000000000000
 45T     210112200141000010000000200000000000010000000000000
 46T     000000000100000000000000000000000000000000000000000
 47T     100031201134000030000000000000000011100000000000000
 48T     000031201124000030000000000000000011100000000000000
 49T     100031201134000020000000000000000011100000000000000
```

Table 14 (continued)

```
                                 ATTRIBUTE

         0000000000000000000000000000000000000000000000000000
         0000000001111111111222222222233333333334444444444555
ITEM     1234567890123456789012345678901234567890123456789012

 50T     3150000100200000000000000000000000000000000011133010
 51T     3050200100200000000000000000000000000000000011133010
 52T     3050510101300000000000000000000000000000000011133110
 53T     2050400000210000000000000000000000000000000011122110
 54T     2150300100200000000000010000000000000000000011133120
 55T     2150400100200000000000000000000000000000000011123110
 56T     2040210000210000000000000000000000000000000011022110
 57T     3150000100200000000000000000000000000000000011122110
 58T     3150000100200000000000000000000000000000000021122110
 59T     3150000100200000000000000100010000000000000031132120
 60T     3150000100200000000000000000010000000000000011122110
 61T     3140000101200000000000000200000000000000000011122010
 62T     2040000100201000000000000000000010000000000001112000
 63T     2140000100101000000000000000000000000000000001112000
 64T     2040000100110000000000000000000010000000000001012000
 65T     2130000001000000000000000000000000000000000011112000
 66T     1010000000000000000000000000000000000000000000000000
 67T     1205000000000000000000000110231010000010000034232011
 68T     1205000000000000000000000100230000000010000034333011
 69T     1205000000000000000000000100230010000010000034433011
 70T     1105000000000000000000000100230010000010000034333010
 71T     1105000000000000000000000100240000000000000033322011
 72T     1205000000000000000000000100120010000010000023322010
 73T     1204000000000001000000000220351120000010000044333020
 74T     1204000000000000000000000110340000000010000033332010
 75T     1211000000100000000000000000000010000000000010111000
 76T     1212000000000000000000000000001100100000100000010111000
 77T     1112001100000000010000000000000000000000000020021210
 78T     1111001000000000000000000000000000000000000020000000
 79T     2121011000000000010000000000000000000000000020121220
 80T     1111001000000000000000000000000000000000000020100000
 81T     1113001000000000000000000000000000000000000032132110
 82T     1112001000000000000000000000000000000000000032100000
 83T     1123001000000000000000000000000000000000000041133120
 84T     1122001000000000000000000000000000000000000041100000
 85T     0000025000112114100000000000002100000000000000011020
 86T     1000015031111114100000000100002100000000000000011120
 87T     1000005500000003100000000000002100000000000000001010
 88T     1000035000011112100000000000002100000000000000001110
 89T     1000005000001002110000000000002000000000000000101110
 90T     1200015000000103100000000000002100000000000000001000
 91T     1100005100230003100000000000002100000000000000001010
 92T     1100003041000001000000000000011100000000000000012110
```

Table 14 (continued)

	ATTRIBUTE
	000000000000000000000000000000000000000000000001111
	555555566666666667777777777888888888899999999990000
ITEM	345678901234567890123456789012345678901234567890123
50T	000030201134000020010000000000000011100000000000000
51T	000031200134000030000000000000000011100000000000000
52T	000031200134000030000000000000000011100000000000000
53T	000021200134000030000000000000000011100000000000000
54T	000031200134000020030000000000000011100000000000000
55T	100021201134000020000000000000000011100000000000000
56T	000021220123000030000000000000000011100000000000000
57T	100021201134000030000000000000000011100000000000000
58T	100021200134000030000000000000000011100000000000000
59T	000031200235000030000000000000000011100000000000000
60T	100020200124000030000000000000000011100000000000000
61T	000021200125000030000000000000000011100000000000000
62T	000010100133000010010000000000000011100000000000000
63T	000010100134000020010000000000000011100000000000000
64T	000010110124000020000000000000000011100000000000000
65T	000011300134000020000000000000000010100000000000000
66T	000000000000000000000000000000000000000000000000000
67T	110114502215000030000000200000000011100000000000000
68T	100114412215000030000000200000000021100000000000000
69T	110124412214000031000000000000000021100000000000000
70T	100114412224100032000000100000000011100000000000000
71T	110114411224000031000000100000000011100000000000000
72T	000024411114100031000000000000000011100000000000000
73T	001124522215100031000000000000000022100000000100000
74T	000124412214100031000000000000000011100000000000000
75T	000012301034000022000000100000000011100000000000000
76T	000013301024210023000000000000010011100000000000000
77T	000020101233001120110000000000000100000000000000000
78T	000011101133001120000000000000000100000000000000000
79T	000030201233000120100000000000000000000000000000000
80T	000011100133000120020000000000000000000000000000000
81T	000010101223000030000000000000000000000000000000000
82T	000010101123001030000000000000000000000000000000000
83T	000011100323000030000000100000000010100000000000000
84T	000010101223000030010000100000000010100000000000000
85T	000040100111010420220011020000000200000000000000000
86T	000041200111001430110012020010000100000000000000000
87T	000040000111000430100001020000000010000000000000000
88T	000040000111010320210011020000000100000000000000000
89T	000041000010001220110002010000001000000000000000000
90T	000041100111000330000002020000000010000000000000000
91T	000030100111000430000012030000000010000000000000000
92T	000031200121000120000001010010000011100000000000000

Table 14 (continued)

ITEM	ATTRIBUTE 0000000000000000000000000000000000000000000000000000 0000000001111111111222222222233333333334444444444555 1234567890123456789012345678901234567890123456789012
93T	0000003010000111000000003201111100000000100010021220
94T	0210003110000003000000002214312100000110000000111110
95T	0000000010000000000000000000000000000000000000000000
1A	0001000000000000000000000011100100000000000021152010
2A	0000001000000000000000000002100000000000000052042130
3A	0001000000000000000000001114210000000000000041331120
4A	0000000000000000000000000000000000000000000020021510
5A	0000000000000000000000000000000000000000000021025120
6A	0000000000000000000000000000000000000000000011011150
7A	0001000000000000000000000011000000000000000010510000
8A	0001000000000000000000000000100000000000000014011000
9A	0000000000000000000000000000200000000000000001000010
10A	0000000000000000000000000000100000000000000012010000
11A	0000000000000000000000000000100000000000000002000000
12A	0000000000000000000000000000200000000000000003000001
13A	0000000000000000000000000000200000000000000004001001
14A	0000000000000000000000000000000000000000000000000000
15A	0001000000000000000000000000000000000000000000000000
16A	0000000000000000000000000000000000000000000001000000
17A	0000000000000000000000000000000000000000000000000000
18A	0000000000000000000000000000000000000000000000000100
19A	0000000000000000000000000000000000000000000000000001
20A	0000000000000000000000000000000000000000000000000005
21A	0000000000000000000000000000000000000000000000000000
22A	0000000000000000000000000000000000000000000000000001
23A	1230000000000000000200000000000000000000000002123110
24A	1230000100000000001000000010100010000010000011123110
25A	2251011100101001000000000010100120000020000022223110
26A	1215000100000000000000000120220120000020000034333020
27A	4321100202000000000000000110001010000022010001123310
28A	4323111200000000000000000000000010000021000001023310
29A	4322012200000001000000000000000120000021100021123320
30A	2522122310000001000000000210000131000244210001011100
31A	2100001001300001000000000000001000110000001000001023010
32A	4300401102100000000000000000010000101000001000001023111
33A	4300401014300001000000000000011001211000002000002034111
34A	4200400013100000000000000000011011101000001000002034310
35A	3010300000100000000000000000111000000000001000012033310
36A	4130001002401001000000000000013000100000001000022033111
37A	2130100003400000000000000000013000100000001000021022100
38A	3010000001411000000000000000000100000000001000011012110
39A	2010010000411001000000000000000000100000001000011012000
40A	1110001000450101100000000000000000110000001000010011000

Table 14 (continued)

	ATTRIBUTE
	000000000000000000000000000000000000000000000001111
	555555566666666667777777777888888888899999999990000
ITEM	345678901234567890123456789012345678901234567890123
93T	000042320111000330100002020030000211100000000000000
94T	000042203111000120000001020000000001110000000000000
95T	000000000000000000000000000000000000000000000000000
1A	000042410122002142220000000010010121000000000000000
2A	000023300213000140100000000010100031000000000000000
3A	000134402213100031010000000000000031100000000000000
4A	000040200312012130110000000020210121000000000000000
5A	000020200323112130120000000010010121000000000000000
6A	000020200112111130120000000030000121000000000000000
7A	001022212122000030101000000000001002100000000000000
8A	001011201122101030011000000000001002110000000000000
9A	005011100121000010000000000000002002110000000000000
10A	012011200121100020002000000000002002110000000000000
11A	011101100031211111301001101001011100200000000000000
12A	121401100020100010000000000000010000200000000000000
13A	123311200020000010000000000000010010200000000000000
14A	011100000021211112221001101001011100100000000000000
15A	001100000022113111111111100100001110010000000000000
16A	011101100021001010000000000000000001020000000000000
17A	001101000010000010000000000000000001000000000000000
18A	320100000032000020000000000000000002100000000000000
19A	520200000041000010000000100000001002100000000000000
20A	110100000030000010000000000000001002100000000000000
21A	220501100041000010000000100000001002110000000000000
22A	250301100041000010000000000000001002110000000000000
23A	110122201153002010000000000000000011200000000000000
24A	000022202153001110000000000000000011100000000000000
25A	000132301235001130120000000000000022200000000100000
26A	110124412235000042000000200000000022200000000100000
27A	000031211224000130000001000012000022200001000000010
28A	000031211134000120000000000002000021200000000000010
29A	000031213224000240000001000002000022200000000000010
30A	000031213124000340000002010002000033200000000000010
31A	111121210131000030000000000010000011200000000000000
32A	110021200122000030000001000002000022200000000000000
33A	111122300131000030000001000001000022200000000000010
34A	110131310242000020000000000010000021200000000000000
35A	010140210322000020030000000000000022200001000000000
36A	100031201223000040020000000020000022100001000000000
37A	100021200222000030000000000020000022100000000000000
38A	110031120322000030000000000020000022100001000000000
39A	000021110122000020010000010000000012100000000000000
40A	000021110121000020010000010000000022100000000000000

Table 14 (continued)

	ATTRIBUTE																																																			
ITEM	001	002	003	004	005	006	007	008	009	010	011	012	013	014	015	016	017	018	019	020	021	022	023	024	025	026	027	028	029	030	031	032	033	034	035	036	037	038	039	040	041	042	043	044	045	046	047	048	049	050	051	052
41A	1	1	1	0	0	0	1	5	0	0	4	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	1	0	0	0
42A	1	1	1	0	0	1	1	0	0	0	4	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0
43A	1	0	1	0	0	0	0	0	0	0	1	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	3	1	0	0
44A	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	4	2	1	1
45A	2	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	2	3	0	0	2
46A	5	1	1	0	0	0	1	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	3	0	1	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2	1	0	4	4	5	5	0
47A	0	2	2	1	0	1	1	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	2	2	2	3	0	0	0	2	0	0	0	0	0	2	1	0	0	0	0	0	0	0	3	2	0	0	0	0
48A	1	0	0	0	0	0	5	0	1	0	0	0	1	1	1	3	1	1	0	0	0	0	0	0	0	1	1	1	0	0	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0
49A	0	1	0	0	0	1	2	1	0	1	1	0	1	0	0	1	0	1	0	0	0	0	0	1	2	2	1	2	0	0	0	1	0	0	0	0	0	2	2	1	0	0	0	0	0	0	0	1	0	0	0	0
50A	1	3	0	0	0	1	4	2	0	0	1	1	0	1	1	1	1	0	0	0	0	0	0	0	1	0	1	1	0	0	1	2	1	0	0	0	0	2	2	1	1	0	0	0	0	0	0	1	1	0	0	0
51A	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	2	0	1	3	0	1	1
52A	2	1	0	0	0	0	3	0	0	0	0	0	0	5	5	1	0	0	0	0	0	1	0	0	1	1	0	1	0	1	1	2	1	0	0	0	0	1	2	1	0	2	0	0	0	1	0	2	2	2	2	0
53A	1	1	0	0	0	0	0	0	0	0	0	0	0	5	5	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	1	0	2	3	2	2	0
54A	3	0	0	0	0	1	0	0	0	0	0	0	0	5	5	0	0	0	0	0	0	0	0	0	0	2	0	1	0	1	1	2	1	0	0	0	0	2	1	0	1	0	0	0	1	2	2	4	4	4	5	0
55A	1	0	0	0	0	0	1	0	0	0	0	2	0	4	4	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	1	0	0	0	1	0	3	3	2	3	0
1J	2	0	0	0	0	0	0	0	1	0	0	1	1	4	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0
2J	1	0	0	0	0	0	0	0	0	0	0	0	0	4	3	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0
3J	1	0	0	0	0	0	1	0	0	0	0	1	0	4	4	2	0	1	1	2	2	2	2	2	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	1	3	0	0	0	0	0	1	1	0	1	0
4J	1	0	0	1	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
5J	1	0	1	1	0	0	1	0	0	0	2	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6J	1	0	1	1	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7J	1	0	1	1	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8J	1	0	1	1	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9J	1	0	2	0	1	0	0	0	0	2	3	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
10J	2	0	2	0	1	0	0	0	0	2	3	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
11J	1	0	1	0	0	0	0	0	0	2	3	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
12J	1	0	1	0	1	0	0	0	0	1	3	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13J	1	0	1	0	2	1	0	0	0	2	4	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
14J	0	0	1	0	1	1	1	0	0	0	3	4	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15J	2	0	1	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	3	0	0	0	0	1	1	0	1	0
16J	1	0	1	0	0	0	0	0	0	0	3	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
17J	1	0	1	0	0	0	0	0	0	0	3	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18J	1	0	0	0	0	0	0	0	0	0	3	1	0	2	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0
19J	0	0	0	0	0	0	1	0	0	0	2	1	5	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
20J	2	1	0	0	3	0	0	0	0	5	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
21J	2	1	0	0	3	0	0	0	1	5	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
22J	2	3	0	0	2	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0
23J	2	1	0	0	3	0	0	4	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0
24J	2	2	0	0	3	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
25J	2	1	1	0	2	0	0	0	0	2	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
26J	2	1	0	0	1	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
27J	1	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0
28J	1	1	1	0	2	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0

Table 14 (continued)

ITEM	ATTRIBUTE 000000000000000000000000000000000000000000000001111 555555566666666667777777777888888888899999999990000 345678901234567890123456789012345678901234567890123
41A	000021110122000020000000100000000022100000000000000
42A	000011100122000010010000000000000021100000000000000
43A	110121110141011010120000000000000012200000000000000
44A	310121200352001111000000100000000011200000000000000
45A	220312300141000010000001300000000011200000000000000
46A	000051310422000150110000000030000142200000000000000
47A	000032111123010220300002010001000121200000000000000
48A	000032200121001320110003110000000011200000000000000
49A	000043220222001520010004020101001022201000001000000
50A	000031112222200530200004020002000132200000000100010
51A	210111200230350000321000200000001111201000000001000
52A	000031213310240210500001200000001432201000000020100
53A	110021201310350010510000100000001533201000001030100
54A	000141321510230010200000000000000533300000001103120
55A	000030210310250010510000100000000422200000001030100
1J	100022220131000100000000500010000000000000000000010
2J	000022121131050110002000500000000410000000000000010
3J	000031212221350111552000001111112510012010000003010
4J	000003310031000110000001310000000000000000000000000
5J	110012110021000100000000200000000000000000000000000
6J	100012110021000100000000000000000000000000000000000
7J	100011110121000100000000100000000000000000000000000
8J	100011100121000100000000100000000000000000000000000
9J	100011100121000120000001000000000000000000000000000
10J	100011110121000120000001000000000000000000000000000
11J	100011110121000120000001000000000000000000000000000
12J	000011110111000120000001000000000000000000000000000
13J	000021120121000120000001000010000000000000000000000
14J	000011110111000110000001000000000000000000000000000
15J	000021130211000120000000000000000000000000000000000
16J	000011120121000110010000000000000000000000000000000
17J	000011110121001110000000000000000000000000000000000
18J	000021110111110110300000000000000001000000000000000
19J	000011110121010110030000000000000000000000000000000
20J	100011200121000110000000101000000000000000000000000
21J	100011200121000110000000101000000000000000000000000
22J	100021100122000120000000101000000000000000000000000
23J	000031110112000120000000101000000000000000000000000
24J	000031100121000120000000000000000000000000000000000
25J	000021100121000120000000000000000000000000000000000
26J	000011100121000110000000000000000000000000000000000
27J	000021110121000110010000000000000000000000000000000
28J	000021100121000110000000000000000000000000000000000

Table 14 (continued)

	ATTRIBUTE
	0000000000000000000000000000000000000000000000000000
	0000000001111111111222222222233333333334444444444555
ITEM	1234567890123456789012345678901234567890123456789012
29J	3100000000000000000000000000000000000000000001001100
30J	3304111110000000000000000001000100000100000011101110
31J	3320111210000000000000000000000100000100000011001110
32J	3200101410000001000000001000001100000100000000001010
33J	2210104110000001100000001001001100000100000000001110
34J	2210121000000001000000000001000100000000000000001000
35J	2000000004200000000000001001100000000000000001001000
36J	2000000004200000000000001001100000000000000001001000
37J	2000100114200000000000001001100000000000000000001000
38J	2101000014100000000000001101100000000000000000001000
39J	2101001011000001000000001101100000000000000000001000
40J	1110101002100000000000000000000000000000000000001100
41J	1000000002100000000000000000000000000000000000001100
42J	1010110001100000000000000000000000000000000000001100
43J	1010000010100001000000002000001000000000000000001100
44J	1000000000100000000000001000000000000000000000001100
1R	0000000021000000142100000010010221220000000000042220
2R	0100001041000001010000000110021100000001000000042330
3R	0000000000000000141000000000300001111100000002142420
4R	0000000010000000011000000110101000000000000000011110
5R	0000000010000000010000000011100010000000000000011110
6R	0120000110000000510000000010000000000010000000011100
7R	1110000100000000321000000000000121010000000000000100
8R	1110000110000000010000001101110110011100110000010110
9R	0100000101100005410000000000004100000010000000022210
10R	0100000100100005430000000010004100000000000000132310
11R	0120000100000002230000000010001100000110000000121210
12R	0010000000000004300000000010002021000120000000000000
13R	0010000010000004511000000010003221011242200000000000
14R	0000000000000000451101000200001443310001000000010110
15R	0000000000110000510000000010000254442021300000000000
16R	0000000000000000053123000000000244141000220000000000
17R	0000000000000000052011000000000254152021330000000000
18R	0000000000000000343121000100000432300000000000000000
19R	0000000000000000251011000100000554300000000000000000
20R	0100000101110110103100000100000433200000000000000000
21R	0000000000000000002000000000001333300000000000000000
22R	0000000000000000100000000112100200010010000001011000
23R	0000000000010010221000001020000220110010000000000000
24R	0000000000000000100000000010000210010010000000000000
25R	1100000141000001000000001211131100000010001000000010
26R	0000001000000000220000000110003200000010000000000000
27R	0100000000000000330000000010003210000030100000000000

Table 14 (continued)

ITEM	ATTRIBUTE 000000000000000000000000000000000000000000000001111 555555566666666667777777777888888888899999999990000 345678901234567890123456789012345678901234567890123
29J	000021200121000100000000000000000000000000000000000
30J	100023302123000140000001010001000010000000000000000
31J	100021202124000130000001010001000010000000000000000
32J	000031222122000140000001010002000010000000000000000
33J	000040211122000230100001010012000011000000000000000
34J	000011200121000130000001010001000010000000000000000
35J	001013310021000110000001010011000000000000000000000
36J	001012210021000110000001010011000000000000000000000
37J	000012210121000120000001000010000010000000000000000
38J	000013310021000110000002010001000010000000000000000
39J	100013300021000110000002110000000000000000000000000
40J	000021110121000120000001000000100000000000000000000
41J	000011110121000110000000000010000000000000000000000
42J	000011110121000110000000000000000000000000000000000
43J	000021120121000110020000000010000010000000000000000
44J	000021120111000220000000000010000010000000000000000
1R	000041110100103112113432123222113110000000000000000
2R	000040210200001120001111031030002010000000000000000
3R	000030100211004021001320012001001010000000000000000
4R	000022110111000020102000012010013110000000000000000
5R	000013220111000010001000000000000010000000000000000
6R	000030110112004021001200001001001010000000000000000
7R	000010004002102023111200014211222210001010000000000
8R	000022223001000030002100003031132021000000000000000
9R	000040000111001110000032030001001021100000000000000
10R	000030100111003122000041030101001021100000000000000
11R	000020000111003020000030010000001021000000000000000
12R	000020000000000010000031030100001031000000000000000
13R	000030000000100010000151030000001032100001000100000
14R	000040000110114211202522124312113211201000001000000
15R	000040000010000100001521024201002233201002102100110
16R	000000003000222113223311024413145211201011001001000
17R	000000004000101001002311014201034233201012102100110
18R	000010003011322113222311123313135210001001000001000
19R	000010002000102111101511013201023222111100000000000
20R	000010003001001210102421031212112321100000000000000
21R	000010003000100000000400001000001121100001000000010
22R	010013220110100010001000000010011001110000000000000
23R	000030000100002110201110011000101211100000000000000
24R	000000004100001010000000000000000002110000000000000
25R	000040210100000010001102031030001021100001000000000
26R	000030001000001011000131010101001011100000000000000
27R	000030001000000000000141030000001032100000000000000

Table 2.14, continued

	ATTRIBUTE
	0000000000000000000000000000000000000000000000000000
	0000000001111111111222222222233333333334444444444555
ITEM	1234567890123456789012345678901234567890123456789012
28R	0000000000000000041000000000001123231010020000000000
29R	0000000000000000013000000020000232220010010000000000
30R	0000000000000010001013010000000221021100030000000000
31R	0000000000000000000001120000000221110000010000000000
32R	0000000000000001150000000115300031140000000000000000
33R	0000000000000001150000000014100031110000000000010010
34R	0000000000000000151000000114200131000001000000000000
35R	0000001101000005420000000001100520000000110000000000
36R	0000000101000005310000000001001431000003100000000000
37R	0000000000000002122000000101100133221021210000000000
38R	0100000100000000111300000101001134222344230000000000
39R	0100000100000000210300000101001244323344440000000000
1P	1000000000000010011011100000000210000100020000101010
2P	0000000000000020000111524100000002200101000400000011 10
3P	0000000000000010001001000000000110000000000000000000
4P	0000000000000000000000000000000000000000000000000000
5P	0000000000000000010020010000000110010210030000000000
6P	0100000000000000010010010000000010010100020000000000
7P	0000000000000000010010000000000120010201030000000000
8P	0000000000000000012001000000000120010101030000000000
9P	0000000000000000011002000000000110010311120000000000
10P	0000000000000000010030000000000010010110130000000000
11P	0000000000000000042421000000000342242010020000000000
12P	0000000000000000041121000100000242021110030000000000
13P	1000000000000000045120000000010332041110120000000000
14P	0000000000000000055131000000000142052120230000000000
15P	0100000000000000050121000000000453152121330000000000
16P	0000000000000000040331000000000343041221230000000000
17P	2000000000103400000110001000000110000210020000011110
18P	0000000000000000040142000000000342042331230000000000
19P	0000000000000000051242000000000342053331130000000000
20P	0000000000000000051032000000000353153342230000000000
21P	0000000000000000042242000000000232042221130000000000
22P	0000000000000000050142000000000332052231130000000000
23P	0000000000000000031233100000000231032100340100000000
24P	0000000000000000032135200000000131031000150000000000
25P	0000000000000000010111000000000121021000020000000000
26P	0000000000000000010011000000000021010000020000000000
27P	0000000000000000010011000000000021020000020000000000
28P	0000000000001100011322100000000121020100030000000000
29P	0000000000000000020111000000000122020100020000000000
30P	0000000000000000024312100000000121020000030000000000
31P	0000000000000000021311100000000121010000020000000000

Table 14 (continued)

ITEM	ATTRIBUTE 000000000000000000000000000000000000000000000001111 555555566666666667777777777888888888899999999990000 345678901234567890123456789012345678901234567890123
28R	000011102000100001112311012202032111302000000000100
29R	000011102000101110301331012101001431101000000000000
30R	000000002000230000321100001100003321001010000003100
31R	000010002000110000101100001100001111001000000000000
32R	000051100010005300000121011000001111100000000000000
33R	000040101110005102100020000001001011100000000000000
34R	000041100110005101000110001001001011200000000000000
35R	000030000010003111001052030001001022200000000000000
36R	000040000000001000000051030001001033200000100000000
37R	000030000000003102101232012201002122200001000000000
38R	000020001000000000001343042301103233311002100200110
39R	000020000000100000001352042311213333311005101200110
1P	000021103020322001410000000101001111100020002002000
2P	010111103110551004340000000002001112100010001003000
3P	000011102011111101210000101121001200001001101100000
4P	000001001011111100110000101220011200011001100100000
5P	000011101000120000103001001400102222215000101101010
6P	000011001000110000101001011500002232214000101101110
7P	000011101000110101105002002400103122204000100101100
8P	000010001000110000101001001400002022214001100101000
9P	000010000000110000002002011501102232214002200100110
10P	000000000000110000002000001300002021114000000000000
11P	000010003000433105224212114214025212212010001002110
12P	000011004000322103213101014312013212201010000002010
13P	000011113101421105114001014115023122211010000001000
14P	000000003000220003102101014204013233212011100001010
15P	000011113000220002005000002201125133313011201104220
16P	000010003000220001112032013202005333302011101104220
17P	000120111100240000510000100100001533301000101103210
18P	000000003000110000001001003200001033213001101101020
19P	000000003000110000000001004303001033211001100101120
20P	000000004000110000001101014201002132211011100101120
21P	000000003000210001000000003201002022211000100101020
22P	000000003000210000001000003200003033211001101101120
23P	000001002000320001001000020114510222110111021020200
24P	000001003000221002001000003112131111210020000001210
25P	000000001011212111311001011101001110020010002000000
26P	000000001011212111111211111111122110110400020010000
27P	000000001001111010101011011401001211014010101001100
28P	000000002000340102420031013113103521011010201103100
29P	000000002000110101100231012101011211011010000001000
30P	000000002000431115031001002125110011011010001001000
31P	000000002000411004110000003111231000000010001001010

Table 14 (continued)

ITEM	ATTRIBUTE 0000000000000000000000000000000000000000000000000000 0000000001111111111222222222233333333334444444444555 1234567890123456789012345678901234567890123456789012
32P	0000000000000000002011100000000132031100020000000000
33P	0000000000000000000000000000000000000000000000000000
34P	0000000000000000000000000000000000000000000000000000
1G	1321221100000000000000001101010000000220000000000000
2G	1411231100000000000000001101000000000230000000000000
3G	3322320000000000000000000000000000000100000000013211
4G	3421230100000000000000000000000000000110100000024211
5G	3311420100000000000000000000110000000100000001034211
6G	2321133100000001000000000100000000000100000000000000
7G	1222021100000000010000000000100100000100000042222011
8G	0104000000000000000010000001100100000000000001111010
9G	0210200041000002100000001301141100000000000000031220
10G	0410110221100002101000001100032130013333300000000010
11G	0410100100000020040000000000114333111200000000000000
12G	1010203400000000000000001101000000000220000000000000
13G	2010203500000000000000001101000000000230000000000100
14G	3000201500000000000000000000000000000100000000012110
15G	3000201500000000000000000000000000000110100000023210
16G	2000300500000010000000000011000000010000000001034311
17G	2010002400000010000000000000001100000110000031122220
18G	1000102500000010000000001000000000000100000000000000
19G	0000100530000002100000001201121100000100000000020220
20G	0100101410100003101000001100022120013343300000000000
21G	0100100511000002104000000000000143331112000000000000
22G	4211401115200001000000001101121000000200100002023111
23G	3110301113200001000000001200111000000200000001034211
24G	4100411112200001000000001100110000000200000001033211
25G	3130101011401001000000001300020100000100000021033211
26G	2030001003410000000000001300020100000100000011022000
27G	3010000001410000000000000101000000000100000001012110
28G	2010000001401001000000000000000010000001000000100110 00
29G	0020011200442001000000000000000010000000000000011000
30G	2100101003300000000000000101010000000110000000001000
31G	2100101002200000000000000101000000000100000000001000
32G	2100111003310000000000000101000000000100000000001000
33G	0000000031000000000000003201230000000100003000000000
34G	0000000021000000000000002101110100000100000000001001
35G	0300211144200002000000000200014112001333330200000000
36G	1300201023310001000000001100032120013333300000000000
37G	1200201013200001004000000010000114333111100000000000
38G	1200201001210001004000001100000014333111110000000000
39G	0200201054100002101000001401131110000211000000021220
40G	2001000000120200000000000000000100000000100000001013101

Table 14 (continued)

ITEM	ATTRIBUTE 000000000000000000000000000000000000000000000001111 555555566666666667777777777888888888899999999990000 345678901234567890123456789012345678901234567890123
32P	000000002000210000005000001001105021102010101102100
33P	000000000000000000000000000000000000000000000000000
34P	000000000000000000000000000000000000000000000000000
1G	000032112224000420000002010001000011100000000000000
2G	000031102224000330000002010001000022100000000000000
3G	100021101124000130000001000001000011100000000000000
4G	100031112124000130000001000001000022200000000000000
5G	110031211123000020000001000002000022100000000000000
6G	000031111124001330010002010000000121100000000000000
7G	100024402224001131000000000000000111200000000000000
8G	000024401123210022000000000000000011100000000000000
9G	000041210101000010000002030011001022100000000000000
10G	000021100001000110000012050100000033210004101100020
11G	000030000001000110001401030100001022210000000000010
12G	000031111212000420000002010001000011100000000000000
13G	000031111112000330000001010001000022100000000000010
14G	000021100123000130000000000001000011100000000000000
15G	000031221123000130000001000001000022200000000000000
16G	110032321222000030000001000002000022100000000000000
17G	000031112123000130000000000001000021200000000000000
18G	000031112123001330010002010001000121100000000000000
19G	000040120100000010000002030011001022100000000000000
20G	000020000001000110000112050100000033210004101100020
21G	000030000000000100001411030100001022110000000000010
22G	212122310122000030000001020010000022100000000000010
23G	110121210222000030010000010010000011100000000000000
24G	210121310221000030010001000002000022100000000000000
25G	110031301213000040010000000010000021100000000000000
26G	000021300213000030000000000010000011100000000000000
27G	110021120322000030000000000020000021100000000000000
28G	000021100122000020000000000000000011100000000000000
29G	000021120122000020010000000000000021100000000000000
30G	001023210112000420000003010101000021110000000000000
31G	000031210212000420010003010101000011100000000000000
32G	000031210212000420000003010101000021100000000000000
33G	000013420010000000000000100031000011100001000000000
34G	100013210020001000000000000001000011100001000000000
35G	000021210000000010010003050120000033210004101100020
36G	000021100000000010000012050100000033210004101100020
37G	000030000000000000001302030100001023210000000000010
38G	000030000000000110001402030100001023210000000000010
39G	000041210100000010000002030020000022200001000000010
40G	210212210131000000000000500000000012200000000000010

Table 14 (continued)

ITEM	ATTRIBUTE 0000000000000000000000000000000000000000000000000000 0000000001111111111222222222233333333334444444444555 1234567890123456789012345678901234567890123456789012
41G	1000000000010201000000000001000000000100000001013101
42G	1002000000000100000000000001100000000100000001013101
43G	0000000000010301000000000000000011200112323000000000
44G	0000000000010201004000000000000001433401010000000000
45G	1101010000200000000000000001100000000100000001013001
46G	1102000011000010010000001101210000000100000011013002
47G	0001001001100000000000000101100000000100000000001000
48G	0100000000000001000000001100111120013222300000000000
49G	0000000000100000103000000000001014334010100000000000
50G	0000022000030101000000000001000000000110000000001000
51G	0000013000000002100000002202121200000122000000000000
52G	0100003010000002100000003213332210000132100010010000
53G	0000012000010102100000001100012120013332300000000000
54G	0000001000010002104000000000000104334000100000000000
55G	0000002030000002300000001411122110000000000000010120
56G	0001001000000001000001001103100110001220000000000001
57G	0000000041000000000100113201330000000003050000011000
58G	2000000010000000000000001501030000002000405111013330
59G	0000000000000000000001111000200200000000324302011001
60G	0000000000000000000000001000010120023112414300000000
61G	0000000051100001000000011401230110002210305100010020
62G	0000000020000000003000100100000013224000120400000000
63G	0000011000010551000000001201001100001231100000000000
64G	1000010000010451000011000100000000000022001000012220
65G	0000010000011451001011000000000010001321010000001110
66G	0000000000011200000021000000001000000100010001013111
67G	0000001000011221000000000201000000000210000000000000
68G	0000003000030542100000001111000100000110000000011110
69G	0000005100010442100000001111001110000100000000011110
70G	0000001000010441114000000000000114333010110000000000
71G	0000011000020552101000001000002120013333300000000000
72G	0000000000000000331101000200000133220000000000000100
73G	0000000100000000250000010200000255342111400000000100
74G	0000000000000000340000000032000354210101000000000000
75G	0000000000000000440000000042000245510100000000000000
76G	0000000000000000520000000041000331210000000000000000
77G	0000000000000001521120001000045415100002000000000000
78G	0000000000000000520000000030000233310000000000011100
79G	0000001000000000540010000010015110000120000000000000
80G	0000000001100004300000000000014210002152000000000000
81G	0000000000000002440000000020004110000000000000010100
82G	0000000000000000353000000010004110000000000000000000
83G	0000000000000000342111000010003210000000000000000000

Table 14 (continued)

	ATTRIBUTE
	000000000000000000000000000000000000000000000001111
	555555566666666667777777777888888888899999999990000
ITEM	345678901234567890123456789012345678901234567890123
41G	110212210131000100000000500000000011200000000000010
42G	111212210131000000000000500000000012200000000000010
43G	000011100000000000000002520000000023210004101100020
44G	000030000000000000000401410000001022210000000000010
45G	210212210032000010000002100000000012200000000000000
46G	310203300132000010000001200000000012200000000000000
47G	110113200021000100000002210000000011100000000000000
48G	000011100000000000000003240100000032210004101100020
49G	000030000000000000001402130100001022210000000000010
50G	000012110010000300000003110000000021100000000000000
51G	000023220000000020000022010000000022100000000000000
52G	000024210000000010000022010000000022110000000000010
53G	000021110000000100000012030000000032110004101100020
54G	000030000000000000000411021000000022110000000000010
55G	000041220100000000000012120010000022100000000000000
56G	010114310010100000000011211000000022210000000000020
57G	000014441000100000010000200050010023100003100000020
58G	000041450410000020000000000050000023210005300100130
59G	132201113110100010000000000030550033210002101000110
60G	000010012000000010000300000030441033211004201100020
61G	000031351100100010010000000050230033210003100000010
62G	000020131000100000001300001040222033110001000000010
63G	000031121200130200400000110000001532110001100103010
64G	000031210300240000500000100000000533110000001003110
65G	000011100100240000400000110000001522110000000003010
66G	110011100120450000400000000000000211100000000002000
67G	000033110000120400200002100000000221100000000001000
68G	000031120200120400400002100000000322100000000001000
69G	000041101201130310400001000000000422100000000001000
70G	000030000000121100300401010000001422221000000001000
71G	000010100000010000100012130000001433210004101101120
72G	000030000010114102101311112201001111100000000000000
73G	000040000000002100102521124201112232110003200100120
74G	000040000000002100001411013200012122110000000000000
75G	000050000000004100001400002100002021100000000000000
76G	000040000000005000000200001000001011100000000000000
77G	000000004000111002113110014302123122101000000000010
78G	000030003000105000000100002100000011100000000000000
79G	000020000010002111001031011101001011100000000000000
80G	000020000000000000000520200000001032210001000000000
81G	000040000010004102000030000001000011100000000000000
82G	000040000000002001000041001100000011100000000000000
83G	000010003000112002101030001101000011100000000000000

Table 14 (continued)

ITEM	ATTRIBUTE 0000000000000000000000000000000000000000000000000000 0000000001111111111222222222233333333334444444444555 1234567890123456789012345678901234567890123456789012
84G	0000000152000002310000113011311100001000000000112220
85G	0000000100000000330000000200001210101110000000000100
86G	0000000000000000010000001000011001001000000000000100
87G	0010000000000000051000000100000000000000000000000000
88G	0000000000000000051000001530002102000000000000000000
89G	0000000000000001011521110000001021110100010000000000
90G	0000000000000001000300000001101100000100000001012100
91G	0000000001000000002400111200001023113000312000000000
92G	0000000000000000002214300000000020011200030000000000
93G	0000000000000000003324410000000021021200130000000000
94G	0000000000000003530100000021004110000000000000000000
95G	0000000000000001300100000000001010000211100000000000
96G	0000000010000003411000000010004120000010000000000000
97G	0000000000000000101101000000001121013422300000000000
98G	0000000000000000123101000010001154430321000000000000
99G	0000000000000000034200100000001144341201100000000000
100G	1000000000000110000130141201000000000000112000012220
101G	0000000000000000000011011000000110000111010000000000
102G	0000000000000001001001000000001121110111020001000000
103G	0000000000000000001314100000000121031111130000000000
104G	0000000000000000000004100001000121010100030000000000
105G	0000000000000100001013100000000110011110030000000000
106G	0000000000000001001011100010002120010221100000000000
107G	0000000000001010002132111000000110021100140000000000
108G	0000000000000000002001000000011130013332420000000000
109G	0000000000000000014001100000000143340111010000000000
110G	1000000000000110000010030100000000000000001000012220
111G	0000000000000110000000000001000100000110000000000000
112G	0000000000000110013000000000000133330001000000000000
1C	0001000000000000000000000100300000000000000000000000
2C	0000000000000000000000000000000000000000000000000000
3C	0000000000000000000000000000000000000000000000000000
4C	0000000000000000000000000000000000000000000000000000
5C	0000000000000000000000000000000000000000000000000000
6C	0001000000000000000000000000000000000000000000000000
7C	0000000000000000000000000000000000000000000000000000
8C	0001000000000000000000000000000000000000000000000000
9C	0000000000000000000000000000000000000000000000000000
10C	0000000000000100000000000000000000000000000000000000
11C	0000000000000000000000000000000000000000000000000000
12C	0000000000000000000000000000000000000000000000000000
13C	2140000000000000000000000000100000000020000000211010
14C	0001000001000000000000000102100000000001000000300001

Table 14 (continued)

ITEM	ATTRIBUTE 000000000000000000000000000000000000000000000001111 555555566666666667777777777888888888899999999990000 345678901234567890123456789012345678901234567890123
84G	000041210100000010000001020120001022100000000000000
85G	000040000000003000000121011000101022100000000000000
86G	000001003100100000000000001000200021100000000000000
87G	000020000011004000000000001000000011100000000000000
88G	000040000000004000000120011100001011100000000000000
89G	000020002000201004000100032050000221100000001000000
90G	100022221130101002000000001003000011200000000000000
91G	000032341100100002000200004132010022200002000000010
92G	000000001000110000101000004400001023111101001101111
93G	000010001000210001011000005302011023110001001102110
94G	000040000000003102000040000202000022100000000000000
95G	000000000000000000000012001403000033111001001000100
96G	000030010000002001000032001201000022110000000000000
97G	000011000000000000000022013502000032211004101100020
98G	000030000000101000000400004201000022110000100100000
99G	000030000000001001000411003402000022111001000000010
100G	000022231210340011150000000010001112100001001002000
101G	000023311100320101104102000200104122112000000003010
102G	000011002000220100005101001200004122112001100103020
103G	000000002000220002002100004214023122112001000002020
104G	000002202000220100002001003400002112114000000001010
105G	000010001000330001203000001100004222112001101104110
106G	000010000000310001000021003101002022111000001103110
107G	000001001000430003121100002222352112110001101003010
108G	000011000000012000003121003302004232211004101102020
109G	000040000000110000101401003200003322211001000001010
110G	000022120210150010010000200010000112100000000000000
111G	000013300110140100004001200000011122100000000000010
112G	000030000000020000001400201000001222200001000000010
1C	001201100020000010000001200000000000000000000000000
2C	000000000010000000000000000000000000000000000000000
3C	000000000000000000000000000000000000000000000000000
4C	000001000001000000000000100000000000000000000000000
5C	000021110000000000000000000000000000000000000000000
6C	000100001001000000000000000000000000000000000000000
7C	000110000000000000000000000000000000000000000000000
8C	000000002000000000000001000000000000000000000000000
9C	000101000000000000000000000000000000000000000000000
10C	000100000000000000000000000000000000000000000000000
11C	000100000000000000000000000000000000000000000000000
12C	000000000000000000000000000000000000000000000000000
13C	000021201012000010000000000000000000000000000000000
14C	000012302010000000000000000000000000000000000000000

Table 14 (continued)

```
                                ATTRIBUTE

          0000000000000000000000000000000000000000000000000000
          0000000001111111111222222222233333333334444444444555
ITEM      1234567890123456789012345678901234567890123456789012

 15C      0000000001000000000000000000020000000100000000100000
 16C      0000000000001000000000000000000000000100000000100000
 17C      1000000300000000000000000000100000000100000000110010
 18C      0000000000120200000000000000000000000100000000100000
 19C      0000000000000000000000000000100000000100000000100000
 20C      1000000000000000000000000000000000000100000000100000
 21C      0000000100000000000000000000000000000000000000000000
 22C      0000000000000000000000000000000000000000000000000000
 23C      0000000000000000000000010000000000000000000000000000
 24C      0000000000000000000000010000000000000000000000000000
 25C      0000000000000000010000110000000000000000000000000000
 26C      0000000000000000000000000000000110000000000000000000
 27C      0000000000000000000000000000000100000000000000000000
 28C      0000000000000000010000000011000000000000000000100000
 29C      0000000000000000000000000000000010000000000000000000
 30C      0000000000000000000000000000000000000000000000000000
 31C      1100000001000000000000000000000100001001200100000000
 32C      0000000000000000010000001110000000000000000000000000
 33C      0000000000000000000000000000000000000000000000000000
 34C      0000000000000000000000000000000000000000000000000000
 35C      0000000000000000100000000000000000000000000000000000
 36C      0000000000000000000000000000000000000000000000000000
 37C      0000000000000000000000000000000000000000000000000000
 38C      0000000000000000100000000000000000000000000000000000
 39C      0000000000000000000000000000000000000000000000000000
 40C      0000000000000000000000000000000000000000000000000000
 41C      0000000000000000000010000000002100000000000000000000
 42C      0000000000000000000020020000000100131114000000000000
 43C      0000000000000000000000000000000000000000000000000000
 44C      0000000000000100000010000000000000001000000000000000
 45C      0000000000000000000000000000000000000000000000000000
 46C      0000000000001100010000000000000100001000000000000000
 47C      0000001001000000000000000000000001001000000000000000
 48C      0001000001100200000000000011000000000020000000001000001
 49C      0000000000000000000001000000000000002000000000000000
 50C      0000000000000000020001000000001200112010000000000000
 51C      0000000000000000000000000000000000000000000000000000
 52C      0000000000000000010001100000000100100000200000000000
 53C      0000000000000000010022000000000310201000400000000000
 54C      0000000000000000012222100000000310301000500000000000
 55C      0000000000000000000101000000000000001000000000000000
 56C      0000000000000000000000000000000000001000000000000000
 57C      0000000000000000000113100000000100001000200000000000
```

Table 14 (continued)

	ATTRIBUTE
	000000000000000000000000000000000000000000000001111
	555555566666666667777777777888888888899999999990000
ITEM	345678901234567890123456789012345678901234567890123
15C	004012400000000000000000000000000000000000000000000
16C	000011100000000010000000000000000000000000000000000
17C	000011100000000010000000000000000000000000000000000
18C	000001100000000000000000000000000000000000000000000
19C	000011201000000000000000000000000001000000000000000
20C	001011201001000000000000000000000000000000000000000
21C	000001000012000110000001000000000000000000000000001
22C	000000000031000110000001000000000000000000000000000
23C	000000000010001000000000000000000000000000000000000
24C	000001000000210100211000000000000000000000000000000
25C	000000000000010400201211001111100010000000000000101
26C	000010000031113221211011000000000100001000000000000
27C	000000000022112210211011000000100100100000000000000
28C	000110000021102120111001000000100100100000000000000
29C	000010000022112221211111001011100210010000000000000
30C	000000000022213211111011001001100100011000000000000
31C	000000001001110021112311132241122222111003200200051
32C	011100000022224222333132122212113301211100000041101
33C	000000000020000100001000200100010000100000000010010
34C	000000000010110011010100101111110100100000000000010
35C	000000000021114212222122122222111201210100000011101
36C	000000000011100100210001000100010100000000000010000
37C	000000000010110011011100101121110200010000000000110
38C	000000000011113211232122222222111201010100000001101
39C	000000000011110100100001001000111100000000000000000
40C	000000000000110001200101000111110100000000000000000
41C	000000001000101002111010001101001100100010000001020
42C	0000000010001101111210122102222101222121000320010104 0
43C	000000000011011111110110001100100100000000000000000
44C	100201000011110012201110122110013114010000000101000
45C	000000000000000000000000000011020201000100000000000
46C	000000000001110221224233232222123432121001000000100
47C	000000000000000110000112211120100011100000000200100
48C	001010100001000200211001110100000311000000000300000
49C	000000000000100101111111101231101122100100001300200
50C	000010001000000010001011011400001122023100301500300
51C	000000001011010110000221210010100000000000200000000
52C	000000001011214222211111122211121110000040000001001
53C	000000002011111111301012022101111111101050001003011
54C	000000002000441104444111012114003412111020101104101
55C	000000000000010010100111100221211110000000000000000
56C	000000000000000000000011100021000011000000000001000
57C	000000001000110100111101003102001100002000000001000

Table 14 (continued)

ITEM	ATTRIBUTE 0000000000000000000000000000000000000000000000000000 0000000001111111111222222222233333333334444444444555 1234567890123456789012345678901234567890123456789012
58C	0000000000000000001125200000000010010100120000000000
59C	0000000000000000001001410000000011010000030000000000
60C	0000000000000000001002410000000011010000130000000000
61C	0010000000000000000000001110001000000000000000000000
62C	0000000000000000000000000000000000000000000000000000
63C	0000000000000000000000000000000000000000000000000000
64C	0000000000000010001000000000000111110110000000000000
65C	0000000000000012000102100000000000001001100000000000
66C	0000000000000000002112210000000011010000020000000000
67C	0000000000000000001001000001000001000000010000000000
68C	0000000000000010000000000000010010000000110000000000
69C	0000000000000011000100011000001001100000100010000000
70C	0000000000000000000001000000000110111000000000000000
71C	0000000100000000000000001011011001100010000000000000
72C	0000000000000000000000000000000100000000000000000000
73C	0000000100000110000000010000100100001011000000000000
74C	0100000010000000101100012000010010014211513200000000
75C	0000000000000000000100000000111100111112101000000000
76C	0000000000000000000100000000000100101011101000000000
77C	0000000000000000000100000001001101111111101000000000
1*[b]	0000000000000000000000000000110000000000000011003120
2*[b]	0000000000000000000000000000000010000000000010000000

Table 14 (continued)

	ATTRIBUTE
	000000000000000000000000000000000000000000000001111
	555555566666666667777777777888888888899999999990000
ITEM	345678901234567890123456789012345678901234567890123
58C	000000001000110001101101003101011200001000000001000
59C	000000001000100000000100002201002101100000001001300
60C	000000001000100001001000003202011100100010001001310
61C	011100000022113322323132122312113300111200000091101
62C	000000000021113212223221122311112200100200000000109
63C	000000000032113211121010011101001000000000000010000
64C	000000000011100110101121011211011322010900001010301
65C	000000000000441003434211011101014403001110000009000
66C	000000001010333012213111012211112101001190000002100
67C	000000000012323222332232022312122214041110006111301
68C	000000000000110011112321133232232314031101006101400
69C	000000000000111111212321022311122413022200003200900
70C	000000000000010000203112011400002212019100102200200
71C	000000000011111111111222022312011113091300002100100
72C	000000000012112232212221122212131217020101002100000
73C	000000000002121231323222233432112423133102301901210
74C	000000000100110121133432143341434343231109300200120
75C	000000000012111231323332232332333494332103100201110
76C	000000001001110121133332122443213433232103901401110
77C	000000000001111121223432232342223466232106301201110
1*[b]	001000000212001030000000000000001000210000000000000
2*[b]	000000004112000030000000000000000002100000000000000

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[a] With the exception of the OAI Mental Activities items (1m to 41m) and the items dealing with Incentives (61c to 77c), the attribute weights of the OAI work elements (items) are based on mean ratings. In the case of the excepted items (1m to 41m and 61c to 77c), however, attribute weights were assigned by one of the investigators.

[b] These variables are no longer included in the OAI. Variable 1* deals with arm-hand manipulations without visual control; 2* pertains to ear-hand and ear-foot coordination.

Appendix D

Reliability Estimates of Attribute-Requirement Ratings

Table 15. Reliability Estimates of Attribute-Requirement Ratings

Attribute Number	Number of Raters (n)	Unadjusted Correlation Coefficient for (n) Raters	Unadjusted Intraclass Correlation Coefficient	Adjusted Correlation Coefficient for (n) Raters	Adjusted Intraclass Correlation Coefficient
1	10	.950	.657	.953	.667
2	10	.918	.529	.924	.550
3	10	.944	.628	.947	.640
4	10	.942	.618	.945	.634
5	10	.945	.630	.945	.633
6	10	.832	.331	.846	.354
7	10	.936	.594	.943	.623
8	10	.969	.757	.971	.767
9	10	.955	.682	.956	.686
10	10	.943	.622	.947	.640
11	10	.962	.718	.963	.725
12	10	.888	.442	.903	.482
13	10	.880	.424	.891	.449
14	10	.963	.723	.966	.739
15	10	.963	.723	.967	.745
16	10	.898	.468	.918	.527
17	10	.952	.665	.954	.676
18	10	.957	.689	.958	.695
19	10	.955	.678	.956	.685
20	10	.932	.579	.935	.588
21	10	.889	.444	.894	.458
22	10	.936	.594	.939	.604
23	10	.900	.475	.906	.489
24	10	.828	.325	.838	.341
25	10	.828	.325	.843	.349
26	10	.894	.458	.905	.488
27	10	.917	.524	.921	.539
28	10	.806	.293	.851	.364

Table 15 (continued)

Attribute Number	Number of Raters (n)	Unadjusted Correlation Coefficient for (n) Raters	Unadjusted Intraclass Correlation Coefficient	Adjusted Correlation Coefficient for (n) Raters	Adjusted Intraclass Correlation Coefficient
29	10	.884	.432	.889	.446
30	10	.897	.467	.902	.478
31	10	.944	.630	.947	.640
32	10	.823	.317	.857	.375
33	10	.948	.645	.955	.680
34	10	.961	.710	.962	.719
35	10	.943	.625	.946	.635
36	10	.951	.661	.953	.668
37	10	.904	.484	.912	.508
38	10	.847	.356	.864	.389
39	10	.893	.455	.909	.499
40	10	.856	.372	.866	.392
41	10	.929	.566	.934	.588
42	10	.956	.687	.958	.696
43	10	.975	.796	.975	.797
44	10	.938	.600	.938	.604
45	9	.877	.443	.889	.470
46	9	.896	.489	.902	.506
47	9	.862	.409	.872	.430
48	9	.919	.558	.930	.597
49	9	.945	.656	.950	.681
50	9	.846	.378	.870	.426
51	9	.881	.450	.892	.479
52	9	.872	.430	.876	.440
53	9	.849	.385	.859	.404
54	9	.824	.342	.833	.357
55	9	.881	.452	.885	.460
56	9	.804	.313	.824	.343

Table 15 (continued)

Attribute Number	Number of Raters (n)	Unadjusted Correlation Coefficient for (n) Raters	Unadjusted Intraclass Correlation Coefficient	Adjusted Correlation Coefficient for (n) Raters	Adjusted Intraclass Correlation Coefficient
57	10	.943	.622	.955	.679
58	10	.891	.449	.924	.549
59	10	.918	.527	.930	.569
60	10	.913	.511	.924	.550
61	10	.920	.534	.927	.558
62	10	.865	.391	.891	.450
63	10	.837	.339	.879	.421
64	10	.931	.574	.937	.600
65	10	.879	.421	.887	.439
66	10	.945	.634	.949	.649
67	9	.936	.620	.941	.640
68	9	.872	.430	.904	.510
69	9	.882	.453	.905	.515
70	9	.913	.537	.916	.547
71	9	.933	.608	.939	.631
72	9	.887	.465	.894	.485
73	9	.923	.570	.929	.591
74	9	.945	.658	.948	.668
75	9	.935	.613	.937	.624
76	9	.808	.319	.843	.373
77	9	.924	.573	.928	.589
78	9	.890	.474	.908	.523
79	9	.939	.629	.943	.647
80	9	.923	.572	.931	.600
81	9	.919	.559	.924	.576
82	9	.894	.483	.906	.516
83	9	.896	.489	.903	.510
84	9	.914	.542	.918	.554

Table 15 (continued)

Attribute Number	Number of Raters (n)	Unadjusted Correlation Coefficient for (n) Raters	Unadjusted Intraclass Correlation Coefficient	Adjusted Correlation Coefficient for (n) Raters	Adjusted Intraclass Correlation Coefficient
85	9	.929	.591	.933	.608
86	9	.943	.649	.949	.675
87	9	.751	.251	.841	.370
88	9	.792	.297	.876	.441
89	9	.679	.190	.799	.306
90	9	.673	.186	.752	.252
91	9	.911	.533	.917	.551
92	9	.879	.446	.884	.459
93	9	.893	.480	.902	.504
94	9	.935	.615	.941	.638
95	9	.830	.352	.842	.372
96	9	.022	.002	.029	.003
97	9	.855	.395	.861	.408
98	9	.827	.347	.838	.366
99	9	.897	.492	.900	.500
100	9	.929	.591	.931	.599
101	9	.827	.347	.840	.369
102	9	.830	.352	.846	.379
103	9	.631	.160	.666	.181

Appendix E

Factor Correlation Matrices for Six Sectional Analyses

Table 16. Factor Correlation Matrix for the Information Received Section of the OAI

	Factor																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Factor																		
1	1.00	.05	.01	.03	.01	.26	.02	.20	.26	.00	-.47	.04	.30	-.03	.02	.00	-.29	.04
2		1.00	.02	-.08	.16	.08	.09	-.07	.07	-.01	-.13	.33	.11	.10	.00	-.11	.00	.12
3			1.00	-.06	.04	.09	-.01	.14	-.01	-.13	-.02	.02	.07	.27	-.07	-.01	.07	-.21
4				1.00	-.10	-.04	.00	.25	.27	-.07	-.02	-.09	-.02	-.06	.17	-.10	-.08	-.13
5					1.00	.03	.15	.05	.21	.03	-.11	.22	.23	.04	.00	-.02	.10	.11
6						1.00	-.02	.15	.10	.09	-.22	.00	.28	-.05	-.02	-.04	-.16	-.04
7							1.00	-.04	.02	-.19	-.02	.21	.04	.18	.04	-.02	.04	-.17
8								1.00	.21	-.06	-.10	-.06	.08	.06	-.01	-.10	-.04	-.08
9									1.00	-.05	-.25	.06	.15	-.05	.09	-.16	-.16	.00
10										1.00	-.01	-.04	.09	-.39	-.03	-.12	-.03	.10
11											1.00	-.09	-.28	.03	-.03	.05	.10	-.05
12												1.00	.07	.09	.09	-.14	.10	.07
13													1.00	-.01	.02	-.02	-.10	.04
14														1.00	.04	.02	.02	-.23
15															1.00	-.04	.03	-.14
16																1.00	.00	.00
17																	1.00	-.02
18																		1.00

Table 17. Factor Correlation Matrix for the Physical Work Behavior Section of the OAI

	Factor																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Factor																		
1	1.00	.11	.29	.22	.25	.26	-.10	-.18	-.08	-.05	.17	.44	.34	.15	.27	.16	-.37	.30
2		1.00	.16	.16	.10	.23	-.17	-.20	.10	-.15	.36	.19	.17	.14	.21	.07	-.05	.32
3			1.00	.11	.26	.21	.00	-.26	.11	-.19	.28	.45	.15	.22	.16	.34	-.21	.22
4				1.00	.11	.00	.00	-.18	.10	-.08	.05	.10	.12	.10	.20	.12	-.14	.18
5					1.00	.20	-.10	-.11	.21	-.18	.14	.27	.12	.02	.22	.38	-.34	.14
6						1.00	-.26	-.16	.01	-.24	.24	.26	.30	.01	.18	.14	-.19	.32
7							1.00	-.01	-.03	.13	-.10	-.25	-.06	.02	-.30	-.01	.02	-.20
8								1.00	.06	.10	-.10	-.15	-.11	-.04	-.15	-.15	.12	-.26
9									1.00	-.14	.02	.10	-.02	.05	.08	.14	-.03	.04
10										1.00	-.10	-.11	-.04	.07	-.11	.01	.13	-.11
11											1.00	.33	.21	.16	.12	.08	-.05	.18
12												1.00	.33	.25	.37	.15	-.31	.31
13													1.00	.16	.17	.06	-.26	.23
14														1.00	.12	.02	-.04	.23
15															1.00	.12	-.26	.30
16																1.00	-.15	.15
17																	1.00	-.20
18																		1.00

Table 18. Factor Correlation Matrix for the Representational Work Behavior Section of the OAI

	Factor						
	1	2	3	4	5	6	7
Factor							
1	1.00	.17	.23	.10	.06	.43	- .08
2		1.00	.34	.18	.05	- .02	.06
3			1.00	.24	.11	.00	- .23
4				1.00	.19	- .09	- .19
5					1.00	.12	- .01
6						1.00	- .09
7							1.00

Table 19. Factor Correlation Matrix for the Interpersonal Work Behavior Section of the OAI

	Factor					
	1	2	3	4	5	6
Factor						
1	1.00	.44	.18	.16	- .43	.48
2		1.00	.32	.26	- .17	.35
3			1.00	.31	- .34	.21
4				1.00	- .28	.08
5					1.00	- .36
6						1.00

Table 20. Factor Correlation Matrix for the Work Goals Section of the OAI

	Factor															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Factor																
1	1.00	-.01	.00	-.08	-.02	.07	-.03	-.02	-.02	-.02	.16	.10	-.07	-.12	.09	-.26
2		1.00	.22	.06	.12	.02	.15	-.07	.06	.32	.06	-.13	.11	.06	-.07	.04
3			1.00	.07	.16	.19	.03	.00	.16	-.07	.08	-.07	.16	.03	-.07	.00
4				1.00	.08	.00	-.04	.12	.10	.00	.10	-.20	-.04	-.04	.15	.00
5					1.00	.12	.08	-.04	.07	.26	.12	-.02	-.05	.01	-.11	.03
6						1.00	-.04	.16	.22	.04	.15	.04	.11	-.10	.18	-.18
7							1.00	-.01	-.07	.13	-.02	-.29	.14	.02	.02	.04
8								1.00	.08	-.02	.13	.00	.00	-.27	.12	-.26
9									1.00	.00	.25	.04	-.05	-.21	-.04	-.20
10										1.00	.04	-.02	.04	-.04	-.01	.00
11											1.00	.05	-.02	-.36	.03	-.32
12												1.00	-.10	.01	.01	-.11
13													1.00	.05	.15	.01
14														1.00	.03	.34
15															1.00	-.13
16																1.00

Table 21. Factor Correlation Matrix for the Work Context Section of the OAI

	Factor											
	1	2	3	4	5	6	7	8	9	10	11	12
Factor												
1	1.00	.01	.17	.24	.10	.17	.09	- .22	.04	.05	.15	.27
2		1.00	- .05	- .10	- .37	.22	- .05	- .04	.19	- .02	- .05	.10
3			1.00	.22	.11	- .10	.18	- .16	- .05	.04	.15	.06
4				1.00	.18	.04	.30	- .23	.00	.07	.33	.16
5					1.00	- .12	- .01	- .02	- .17	.06	.06	- .05
6						1.00	.03	- .14	.21	- .03	.06	.18
7							1.00	- .14	- .01	.03	.22	.13
8								1.00	- .03	- .07	- .17	- .39
9									1.00	.01	- .04	.16
10										1.00	.05	.02
11											1.00	.17
12												1.00

Appendix F

Matrices Containing Coefficients of Factorial Stability

Table 22. Coefficients of Congruence for Information Received Factors

	Analysis B																	
Analysis A	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	.97	.08	.00	.09	.00	.02	.01	.10	.02	-.01	-.25	-.03	.21	-.02	.01	.20	.16	-.03
2	-.03	.3	.09	-.04	.05	-.20	.16	.02	.06	-.08	.01	-.30	.06	.20	.01	-.04	.00	.87
3	.00	.06	.98	.06	.02	-.05	-.01	.06	-.04	-.02	.00	-.11	.05	.20	.04	-.03	-.01	.17
4	.04	-.03	-.12	-.06	.02	.50	-.03	.54	-.03	-.01	-.06	-.36	-.02	-.07	-.05	-.05	.51	-.05
5	-.02	.15	.02	.02	.98	-.03	.08	.00	-.02	-.07	-.04	.00	.18	-.06	.04	-.02	.10	.02
6	.10	.05	.02	.96	.00	.10	-.03	.08	-.05	.00	-.10	.03	.23	.01	.00	.47	.00	-.02
7	.00	.06	-.02	.00	.16	-.07	.94	.01	.01	-.09	-.02	-.12	.04	.18	.15	-.01	.04	.06
8	.02	.05	-.02	.01	-.01	.32	.03	.02	.96	-.02	-.02	-.03	.02	.09	.07	.00	.12	.02
9	.09	-.01	.10	.13	.06	.00	-.01	.91	.01	.02	-.04	-.03	.11	.14	-.17	.06	-.04	.03
10	.25	.13	.02	.08	.03	.01	.03	.06	.00	-.04	-.09	.02	.21	.00	-.01	.11	.18	-.03
11	.00	-.03	.08	.01	-.03	-.11	.17	.06	.05	-.02	.01	-.89	-.05	.20	.24	-.02	-.06	.37
12	-.01	.33	-.02	.00	.10	-.06	.13	-.02	.01	-.97	-.03	.00	.06	-.03	.06	-.04	.04	.04
13	.22	.10	.06	.20	.13	.01	-.01	.09	.00	.01	-.24	.07	.91	-.06	.02	.08	.28	-.01
14	-.06	-.96	.01	-.08	-.08	.15	-.04	.01	.03	.17	.06	-.01	-.08	.08	-.03	-.02	-.06	-.03
15	.20	.12	-.02	.06	.00	.13	.00	.10	-.02	.01	-.10	-.02	.09	.00	-.05	.77	.68	-.02
16	.00	-.10	.05	.01	-.07	.52	.10	.12	.14	.07	.01	-.06	-.02	.84	-.01	-.02	.27	.10
17	.06	.05	.04	.20	.23	-.09	-.02	.06	.06	-.06	-.11	.00	.01	.03	-.24	-.15	.74	-.05
18	.03	-.27	.00	-.02	.06	-.35	-.19	-.02	-.08	.07	.00	.04	-.07	.00	.74	-.04	-.15	.04

Table 23. Coefficients of Congruence for Physical Work Behavior Factors

	Analysis B																	
Analysis A	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	.92	.21	.04	-.20	.25	-.15	.19	.18	.12	-.03	.27	.18	-.33	.44	.10	-.45	.25	.28
2	-.18	-.06	-.04	.95	-.04	.02	-.05	-.13	-.23	-.03	-.08	-.36	.18	-.10	-.19	.21	-.09	-.30
3	.12	.13	-.03	-.19	.43	-.08	.06	.03	.71	-.10	.02	-.20	-.06	.08	.10	-.31	.10	-.15
4	.21	.01	.06	-.05	.05	.04	.97	.03	.06	.00	.11	.04	-.07	.12	.10	-.13	.11	.15
5	.15	.14	.95	-.04	.03	.04	.08	.20	.05	-.09	.18	.14	-.09	.15	.11	-.08	.18	.12
6	.18	.27	.10	-.05	.04	-.03	.02	.13	.06	-.88	.29	.06	-.23	.11	.19	.02	.49	.04
7	.15	.09	.06	-.13	.69	.13	.06	.04	.24	-.03	.04	.20	-.19	.10	.17	-.31	.10	.33
8	.25	.22	.17	-.12	-.02	-.10	.17	.06	.15	-.04	.84	.11	-.18	.17	.06	-.22	.17	.46
9	-.12	-.90	-.08	.13	-.06	.02	.01	-.22	-.06	.11	-.23	-.10	.07	-.19	-.24	.06	-.15	.09
10	-.25	-.02	.18	-.09	-.11	.01	.04	.18	-.09	.03	-.08	-.56	.01	-.25	-.03	.02	-.15	-.18
11	.18	.15	.20	-.19	.07	-.04	.09	.91	.06	.08	.25	.35	-.25	.27	.14	-.14	.13	.13
12	.32	.17	.05	-.16	.10	-.02	.07	.21	.16	-.13	.20	.39	-.95	.26	.14	-.14	.33	.22
13	.34	.34	.08	-.10	.08	-.06	.09	.28	.11	-.06	.27	.18	-.25	.90	.09	-.19	.13	.08
14	-.17	-.20	-.07	.18	-.23	-.07	-.08	-.12	-.11	.07	-.20	-.07	.14	-.09	-.86	.28	-.10	.13
15	.26	.08	.05	-.11	.19	-.01	.14	.08	-.00	.02	.31	.15	-.24	.27	.22	-.51	.70	.03
16	-.15	-.26	-.07	.05	-.25	.06	.00	-.03	.27	.30	-.22	-.15	.23	-.16	-.31	.12	-.19	.26
17	.44	.34	.03	-.08	.27	-.26	.12	.20	.26	-.07	.16	.17	-.21	.22	-.12	-.43	.22	.34
18	.01	.04	.05	-.08	.19	.80	.06	.02	.39	-.05	.10	.31	-.10	.01	.04	-.14	.16	.03

Table 24. Coefficients of Congruence for Representational Work Behavior Factors

	Analysis B						
	1	2	3	4	5	6	7
Analysis A							
1	.87	.21	-.06	.06	-.17	.11	-.18
2	-.09	-.97	-.18	-.18	-.13	.13	-.04
3	.24	-.12	.29	.45	-.08	-.61	.08
4	.20	.13	.96	.06	.13	.11	-.08
5	-.05	.01	.14	.79	.25	.59	.11
6	.50	-.07	.20	.33	.56	-.22	-.61
7	.60	.01	.08	-.13	.33	.08	-.68

Table 25. Coefficients of Congruence for Interpersonal Work Behavior Factors

	Analysis B					
	1	2	3	4	5	6
Analysis A						
1	.98	-.17	.10	.08	.26	.30
2	.15	-.97	.10	.11	.03	.31
3	.01	-.12	.71	.25	.01	-.12
4	.23	-.06	.27	-.10	.84	.60
5	.06	-.08	.26	.81	.43	.04
6	.16	-.11	.71	-.03	.26	.24

Table 26. Coefficients of Congruence for Work Goals Factors

	Analysis B															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Analysis A																
1	.28	.01	-.09	-.05	-.04	-.08	-.03	.17	-.44	.37	.28	.01	.04	.39	-.05	-.62
2	.02	.98	.20	.03	.05	.05	.13	.01	-.02	-.01	.05	.11	-.10	-.01	.00	.04
3	.05	.13	-.04	.06	.09	.22	.05	-.00	.17	.01	.11	.96	-.10	.04	-.05	-.13
4	.06	.04	-.00	.97	.01	-.05	-.00	.06	.02	.00	.03	.04	-.11	.03	.03	.08
5	.03	.04	.17	.03	.96	-.08	.09	.02	.10	-.01	.17	.09	.01	-.01	.10	.02
6	.09	.02	.02	.03	.08	.37	-.05	.04	.37	.12	.89	.13	.03	.01	-.23	-.17
7	.00	.12	.05	-.01	.08	.09	.94	-.01	.01	-.05	-.10	.02	-.27	-.05	-.01	-.17
8	.07	-.02	-.02	.03	-.04	.03	-.07	.95	.29	.15	.02	.01	-.05	.12	-.07	-.18
9	.17	.07	-.03	.15	.07	.00	-.02	.01	.45	.44	.06	.08	-.07	.37	-.64	.14
10	.98	.02	.01	.06	.01	-.01	-.01	.08	.06	.14	.13	.05	.01	.31	-.04	-.02
11	.05	.24	.97	.00	.19	.00	.06	-.03	.01	.01	.01	-.04	-.05	.02	.00	-.04
12	-.02	.08	-.01	.12	-.01	-.08	.23	-.04	.05	-.03	.00	.04	-.94	-.05	.20	.04
13	.00	.09	.01	-.05	-.02	.78	.12	-.03	.02	-.01	-.06	.06	-.17	.00	.34	.05
14	-.29	.01	-.02	-.05	.01	.03	.02	-.14	-.17	-.18	-.05	-.01	-.01	-.95	.02	.10
15	.22	-.02	.03	.02	-.00	.09	-.06	.20	-.09	.90	.15	-.04	.07	.20	.00	-.18
16	-.02	.14	-.03	-.16	.06	-.50	-.07	-.24	.37	-.08	-.27	.06	.08	-.02	.24	-.28

Table 27. Coefficients of Congruence for Work Context Factors

	Analysis B											
	1	2	3	4	5	6	7	8	9	10	11	12
Analysis A												
1	.08	.28	-.02	.77	.02	.18	.02	.02	.51	.03	.28	.00
2	.29	-.01	.17	.03	.20	-.14	.21	.13	-.19	.72	-.35	-.01
3	.05	-.01	.66	-.04	.27	.07	.05	.26	.07	.16	-.26	.07
4	.07	.72	.02	.09	-.14	-.01	-.03	-.01	.21	-.11	.05	.40
5	.89	.01	.03	.00	.19	.15	.32	.06	.01	.37	.07	-.01
6	.11	.00	.12	.01	.10	.07	.04	.82	.05	.13	-.10	.16
7	-.25	-.02	-.06	.06	-.43	-.66	-.37	-.07	-.07	-.18	.14	.02
8	.03	-.04	.77	-.04	-.12	.04	.14	.12	.02	.10	.10	-.47
9	.06	-.04	.18	-.01	.58	-.05	.14	.36	-.17	.14	.14	-.02
10	-.27	.00	-.15	.01	-.27	-.04	-.80	-.13	.12	-.06	.02	-.13
11	.02	.62	-.08	.14	.01	.36	.02	-.02	-.21	.10	.22	.01
12	.16	.06	.28	.21	.28	.02	.24	.09	-.30	-.03	-.17	.03

Table 28. Correlations Between Factors Obtained From Two Analyses of Information Received

Analysis A	Analysis B 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	.93	.19	-.03	.17	.04	.06	-.08	.28	.06	.04	-.45	-.05	.32	.01	-.01	.36	.32	-.16
2	-.08	.12	.24	-.08	.08	-.26	.11	.04	.02	-.13	.04	-.26	-.04	.38	.13	-.09	-.02	.80
3	-.04	-.01	.95	.11	-.03	-.11	-.07	.19	-.10	-.06	.04	-.02	-.10	.41	.10	-.09	-.02	.28
4	.30	.04	-.02	.01	.01	.54	-.08	.57	.01	.05	-.26	-.27	.14	-.01	-.10	.03	.54	-.24
5	-.02	.21	.09	.01	.92	-.05	.00	.10	-.09	-.09	-.12	-.11	.26	.07	.03	.03	.25	-.01
6	.24	.17	.05	.90	.11	.02	-.07	.00	-.11	-.02	-.14	.09	.34	.03	.00	.41	.05	-.01
7	-.04	.03	-.04	-.02	.24	-.07	.90	-.07	-.03	-.21	-.03	-.17	.05	.28	.15	-.06	.10	.20
8	.11	.03	-.04	.01	-.01	.22	.03	.02	.90	-.12	-.05	-.06	.06	.15	.01	-.07	.09	-.03
9	.27	.00	.17	.33	.12	-.01	-.03	.87	-.01	.07	-.22	.07	.27	.20	-.17	.14	.15	.01
10	.19	.19	-.04	.06	.05	-.03	-.02	.04	.03	-.04	-.92	.02	.08	-.04	.01	.10	.16	-.11
11	-.10	-.10	.21	.00	-.05	-.14	.14	-.02	.01	-.02	.08	-.78	-.13	.33	.28	-.06	-.12	.42
12	-.13	.32	-.03	-.05	.14	-.12	.09	-.16	.05	-.92	.08	-.10	-.02	-.02	-.08	-.10	-.07	.02
13	.35	.20	-.04	.27	.26	.00	-.10	.14	-.04	.10	-.36	-.03	.90	-.07	.07	.22	.33	-.14
14	.07	-.80	.07	.06	-.10	.20	-.04	.24	.05	.27	-.05	.15	.05	.09	-.08	.02	.11	-.02
15	.46	.19	-.03	.09	.05	.20	-.11	.31	.02	.03	-.29	-.02	.26	.00	-.15	.70	.68	-.21
16	.19	-.08	.13	.08	-.12	.50	.06	.32	.16	.12	-.16	.03	.14	.72	-.07	.01	.35	-.02
17	.17	.12	.09	.30	.32	-.02	-.06	.28	.07	-.05	-.25	-.10	.14	.12	-.31	-.05	.82	-.17
18	.05	-.23	.01	.08	-.02	-.30	-.17	-.04	-.11	.18	.01	.06	-.08	.02	.76	.07	-.15	.01

Table 29. Correlations Between Factors Obtained From Two Analyses of Physical Work Behavior

	Analysis B																	
Analysis A	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	.86	.28	.11	-.35	.23	-.20	.40	.34	.26	.00	.32	.22	-.28	.39	.18	-.35	.24	.19
2	-.18	-.12	-.20	.88	-.08	.03	-.22	-.22	-.30	-.17	-.09	-.26	.20	-.18	-.19	.28	.01	-.25
3	.10	.12	.04	-.34	.47	.10	.17	.02	.80	-.01	.01	-.20	-.11	.10	.03	-.39	.00	-.11
4	.20	.11	.25	-.16	.06	.14	.86	.16	.10	.03	.13	.15	-.03	.19	.12	-.30	.08	.20
5	.16	.06	.88	-.11	.04	.07	.24	.29	.07	-.02	.13	.04	.03	.13	.13	-.26	.04	.09
6	.12	.22	.26	.01	.03	.04	.14	.22	.03	-.84	.36	.01	-.15	.04	.24	-.20	.41	.02
7	.02	.20	.10	-.24	.62	.10	.20	.23	.27	.01	.15	.21	-.20	.10	.23	-.35	.11	.17
8	.21	.03	.29	-.10	-.03	-.06	.23	.04	.20	.09	.60	.07	.00	.10	.00	-.38	-.08	.58
9	-.23	-.76	-.24	.08	-.17	.06	.01	-.25	-.15	.06	-.28	-.18	.08	-.36	-.21	.22	-.04	.19
10	-.29	-.04	.19	-.09	-.12	.01	-.04	.14	-.12	.09	-.06	-.54	.08	-.16	-.08	.09	-.24	-.22
11	.22	.04	.28	-.13	.11	-.08	.13	.71	.06	.14	.11	.28	-.14	.15	.09	-.20	.03	.08
12	.43	.29	.26	-.36	.19	-.10	.27	.39	.24	-.25	.38	.45	-.86	.37	.21	-.20	.38	.22
13	.33	.26	.12	-.04	.16	-.19	.18	.28	.16	.00	.22	.18	-.26	.86	-.05	-.29	.05	.15
14	-.19	-.14	-.15	.22	-.31	-.08	-.23	-.15	-.16	.00	-.21	-.17	.22	-.19	-.75	.35	-.07	.06
15	.29	.10	.12	-.26	.22	-.05	.37	.06	.14	.07	.25	.17	-.33	.28	.16	-.67	.65	.14
16	-.29	-.04	-.05	.09	-.36	.02	-.02	.14	.12	.16	.00	-.06	.26	-.10	-.04	.37	.01	.15
17	.38	.27	.07	-.10	.21	-.24	.17	.23	.37	-.10	.13	.21	-.20	.13	-.05	-.39	.14	.36
18	-.05	.03	.15	-.06	.13	.84	.15	.07	.21	-.05	.15	.27	-.07	-.06	.14	-.19	.11	-.02

Table 30. Correlations Between Factors Obtained From Two Analyses of Representational Work Behavior

	Analysis B						
Analysis A	1	2	3	4	5	6	7
1	.79	.25	-.06	.02	-.12	.21	-.20
2	-.15	-.92	-.36	-.19	-.08	.07	-.04
3	.24	-.04	.36	.41	-.11	-.59	.03
4	.23	.28	.90	.11	.20	.08	-.09
5	-.08	.07	.21	.69	.22	.41	.13
6	.55	-.05	.32	.26	.54	-.14	-.72
7	.49	-.02	.07	-.19	.28	.06	-.53

Table 31. Correlations Between Factors Obtained From Two Analyses of Interpersonal Work Behavior

	Analysis B					
Analysis A	1	2	3	4	5	6
1	.93	-.39	.19	.04	.47	.44
2	.46	-.84	.20	.21	.27	.44
3	.07	-.38	.45	.26	.04	.08
4	.40	-.16	.46	-.02	.85	.55
5	.16	-.11	.32	.76	.52	-.03
6	.30	-.25	.54	.17	.45	.24

Table 32. Correlations Between Factors Obtained From Two Analyses of Work Goals

	Analysis B															
Analysis A	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	.28	.00	-.04	-.10	-.03	-.05	.10	.16	-.46	.36	.32	-.10	.03	.36	.09	-.55
2	.07	.91	.36	.01	.14	.01	.04	-.08	.01	-.03	.06	.13	-.04	-.01	-.06	.06
3	-.14	.21	-.07	-.08	.10	.20	.10	-.14	.17	-.11	-.15	.80	-.08	-.13	-.02	-.10
4	.03	.13	.09	.92	.10	-.04	-.01	.10	.05	-.10	.05	.06	-.24	.00	-.05	.24
5	-.16	.08	.21	-.09	.85	-.23	.09	-.15	-.02	-.20	-.23	.02	.06	-.17	.22	.03
6	.15	-.02	-.02	-.12	.18	.31	-.10	.10	.44	.14	.77	.02	.14	.11	-.31	-.22
7	-.02	.19	.13	-.07	.12	.06	.91	-.02	.06	-.10	-.11	-.03	-.27	-.04	-.04	-.18
8	.20	-.13	-.04	.12	-.10	.12	-.10	.86	.29	.14	.04	-.01	-.04	.24	-.13	-.10
9	.32	.06	-.04	.20	.10	.04	-.11	.08	.42	.43	.20	-.05	-.01	.40	-.62	.15
10	.91	.19	.09	.14	.12	.05	.02	.13	.04	.28	.25	.03	.02	.36	-.02	.02
11	.08	.26	.86	.24	.25	.00	.05	.09	-.02	.01	.10	-.08	-.04	.13	.02	-.06
12	-.04	.08	.04	.19	-.03	-.11	.24	.01	.05	-.05	-.02	.03	-.86	.00	.16	.06
13	-.01	.12	.08	-.06	-.07	.73	.12	-.05	.08	-.02	.02	.00	-.15	-.04	.30	.05
14	-.48	-.07	-.10	-.03	-.08	-.04	.04	-.24	-.23	-.38	-.15	.00	.01	-.89	.08	.09
15	.31	-.02	.04	-.03	.03	.10	-.04	.24	-.14	.78	.28	-.10	.13	.21	.01	-.16
16	-.03	.13	-.04	-.12	.12	-.60	-.18	-.32	.35	-.03	-.32	.04	.03	.01	.23	-.24

Table 33. Correlations Between Factors Obtained From Two Analyses of Work Context

	Analysis B											
Analysis A	1	2	3	4	5	6	7	8	9	10	11	12
1	.14	.26	-.15	.04	-.08	.25	.00	-.20	.05	-.09	.06	-.15
2	.35	-.07	.30	-.02	.20	-.09	.27	.18	-.16	.72	-.33	.06
3	.05	.02	.56	-.05	.23	.14	.15	.15	.04	.13	-.31	-.06
4	.00	.58	-.09	.09	-.14	-.02	-.14	-.09	.49	-.22	.09	.21
5	.77	.14	-.06	.08	.03	.12	.12	-.10	-.01	.08	.23	-.16
6	.07	.09	.27	.06	.03	.10	.03	.75	.22	.07	.00	-.06
7	-.45	.18	-.05	.04	-.19	-.66	-.10	-.10	.08	-.06	.08	-.01
8	.04	-.10	.71	-.11	-.11	.02	.18	.06	-.04	.19	.07	-.41
9	.16	-.05	.27	-.04	.61	-.01	.16	.37	-.10	.10	.12	-.09
10	-.48	-.13	-.22	.03	-.21	-.05	-.68	-.23	.08	-.14	.06	-.27
11	-.03	.64	-.18	.12	-.16	.28	-.16	-.17	-.08	-.03	.19	.09
12	.12	.12	.26	.19	.22	-.01	.20	.06	-.16	.06	-.07	-.10

Appendix G

Factor Correlation Matrix for the Higher-Order Analysis

Table 34. Factor Correlation Matrix for the Higher-Order Factor Analysis

	Factor																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Factor																					
1	1.00	.06	.07	.00	- .06	- .04	- .18	.12	.11	- .07	.14	.00	- .11	.02	- .12	- .05	- .01	.34	- .09	- .16	- .02
2		1.00	- .04	.19	.00	- .01	- .04	- .10	.21	.08	.08	.30	- .01	.17	- .07	- .03	.17	.05	- .07	- .03	.06
3			1.00	- .04	.05	- .04	- .04	- .16	.09	- .09	.02	- .04	- .02	.05	- .01	- .06	.00	- .10	.17	- .03	- .07
4				1.00	.02	.06	.02	- .03	- .04	- .02	- .04	.03	.00	.06	- .08	- .01	.05	- .02	.06	- .01	.04
5					1.00	- .01	.12	- .01	- .08	.10	- .06	- .02	.09	- .09	.06	- .08	- .10	- .07	- .02	- .07	- .02
6						1.00	.03	- .07	- .07	.04	- .02	.08	.02	.12	.03	.08	- .02	.05	.10	.02	- .06
7							1.00	- .02	- .08	- .03	- .14	- .06	.17	- .03	.07	- .05	- .09	- .07	.07	- .01	.16
8								1.00	- .08	.00	.01	- .13	- .03	- .07	.04	- .06	.02	.04	- .07	- .02	.06
9									1.00	.10	.06	.08	- .08	.08	- .06	- .06	.04	.00	- .01	- .02	- .02
10										1.00	.02	.09	.00	.04	- .06	- .03	.03	- .05	- .04	- .04	- .03
11											1.00	.07	.00	.02	- .08	.06	.09	.18	- .16	- .05	- .04
12												1.00	- .01	.12	- .08	.04	.05	.06	- .08	.00	.01
13													1.00	.01	.03	.00	- .04	- .01	- .03	.10	.06
14														1.00	.02	.05	.05	.00	.12	- .09	.00
15															1.00	.06	- .07	- .19	.12	.10	.01
16																1.00	.07	- .02	.00	- .01	- .01
17																	1.00	.08	- .02	- .07	.15
18																		1.00	- .22	- .15	- .01
19																			1.00	- .03	.01
20																				1.00	- .06
21																					1.00